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THE BAKER & TAYLOR COMPANY
NEW YORK

THE CAMBRIDGE UNIVERSITY PRESS
LONDON

THE MARUZEN-KABUSHIKI-KAISHA
TOKYO, OSAKA, KYOTO, FUKUOKA, SENDAI

THE MISSION BOOK COMPANY
SHANGHAI

STUDIES IN THE ECONOMICS OF OVERHEAD COSTS

BY

J. MAURICE CLARK
PROFESSOR OF POLITICAL ECONOMY
UNIVERSITY OF CHICAGO

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THE UNIVERSITY OF CHICAGO PRESS
CHICAGO, ILLINOIS

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Published December 1923

Composed and Printed By
The University of Chicago Press
Chicago, Illinois, U.S.A.

TO MY FATHER

PREFACE

This volume is a bit of research into the principles of dynamic economics. It is an experiment in a type of economic theory which is largely inductive, which comes to grips with the dynamic movements and the resistances to movement, and the organic interrelations of parts, which make our economic world a dynamic social organism, rather than a static mechanism with an endless uniformity of perpetual motion. It studies the discrepancies between supply and demand; indeed the whole subject of the book might be defined as a study of discrepancies between an ever fluctuating demand and a relatively inelastic fund of productive capacity, resulting in wastes of partial idleness, and many other economic disturbances. Unused capacity is its central theme.

This subject, of costs which are not traced to units of output, or do not vary with output, has challenged the author's scientific interest for years. From being a mere exception to the general laws of value and efficiency it has grown to be a large and important section of economic principles. And now the question seems to be whether it can best function as an autonomous department of economics, or whether the whole body of economic thought must become an "economics of overhead costs" in the sense of being integrally built upon this as a part of its foundation. In the latter case, the new groundwork would need to include many other equally important and equally fundamental facts of human nature and industry, all of which together would furnish an adequate and convincing background for a picture of the dynamic, organic, and social qualities of our industrial life.

The author has sometimes said that a graduate class in economic theory would be a success if the students gained from it a real understanding of the meaning of cost in all its many aspects. He believes that the economist may well study the accountant's conceptions of cost, since they constitute economic forces which affect the conduct of business and the laws of value and production. But he believes just as strongly that the accountant should know the meaning of cost from the standpoint of disinterested economic science, because it embodies, in a sense, that impossible goal to which his practical devices serve as approximations. Thus one task of this work has been to try to throw the light of these two conceptions upon each other—with what success the reader must determine.

A word of explanation may be in order as to why this bit of experimental research in economic theory should appear in a series of "Materials for the Study of Business." The fundamental reason is twofold. The author of the book believes in carrying theoretical study into the realm of those facts and forces with which business is consciously in contact (as it is often not consciously in contact with the traditional abstract levels of long-run equilibrium) and generalizing upon that great wealth of inductive material which is accumulating at an ever increasing rate and for which our schools of business are so largely responsible. And the editors of this series believe that a study of the laws of industry from the broadest social standpoint, and from the standpoint of the search for useful truth of whatever color, is a vitally necessary part of business education. And such a testimonial to the practical worth of theoretical study is, to say the least, worth accepting on behalf of theoretical economics.

While the book was not originally planned as a commercial text, the material has been used as the basis of a course in which students of the School of Commerce have participated, along with students in the Department of Political Economy. The course has been given three times, the students have contributed valuable data and an invaluable service of criticism and discussion, and the professor's resignation has not yet been requested. In fact, he has been strengthened in the conviction that a course covering this subject-matter fills a very important niche in any university curriculum and he looks to see such courses become fairly numerous in the near future.

The author has tried to put the argument in such form that business men would find it readable, if they were willing to deal with some few unfamiliar terms and to accept the standpoint of a search for the laws of economic efficiency in the large, rather than of that narrow commercial efficiency which breeds the convulsions that sap the strength of business as a whole. Such readers might do well to omit chapter xxiii, dealing with the theory of marginal productivity, but it is the author's earnest hope that they will find the bulk of the argument worthy of their attention. The subject it deals with, especially the discrepancies between commercial and community measures of efficiency, is as important as any which is before us today, and the importance of the theme may make up for shortcomings in the author's presentation.

Grateful acknowledgments are due to more individuals than can be named. First of all to my wife, whose suggestions have had more value than she would admit, whose probable comments have been constantly in my mind, affecting the form of the entire work, and who has devoted to it an amount of toil which can never be adequately recognized by that too conventionalized reward of the author's wife, a mention in the Preface. I have also profited by discussions of particular phases of this work with my colleague, Professor Jacob Viner, and my former colleague, Professor F. H. Knight, now of the University of Iowa. Professor J. O. McKinsey of the School of Commerce and Administration of the University of Chicago kindly read and commented on one part of the manuscript. Acknowledgment is also due to the members of the classes who have worked with me over this material, and to the entire group of teachers and students at the University of Chicago, whose spirit of realism and intimate contact with economic facts have furnished a mine of suggestion and a salutary corrective for the overabstract tendencies of the theorist.

As for the many writers who have written on one phase or another of this subject, partial acknowledgment is made in the course of the text, though no one can ever know all the influences which have helped form his ideas on any large subject. The greatest debt of all is to my father, who started me in this field of inquiry as a graduate student, who has followed my work with a combination of generous interest and wise refraining from interference, and to whom this work is dedicated as a very small contribution toward realizing his conception of a dynamic economics.

JOHN MAURICE CLARK

CARMEL, CALIFORNIA
August 29, 1923

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CHAPTER I

THE GRADUAL DISCOVERY OF OVERHEAD COSTS

SUMMARY

Preliminary definition of overhead costs, 1—Expenses of production under handicraft and domestic systems, 1—Discrimination natural, 2—Growth of the one-price system, 5—Some early references to overhead costs, 5—Machine versus man: how their costs behave, 7—Overhead costs on railroads, 9—Overhead costs in other industries, 11—Hadley's summary of the problem, 12—The contribution of cost accounting, 14—Developments in public utilities, 14—Labor as an overhead cost, 15.

1. PRELIMINARY DEFINITION OF OVERHEAD COSTS

What are "overhead costs"? The term is nowadays much used and variously defined; in fact, it covers an entire family of ideas, but they have one essential thing in common. They refer to costs that cannot be traced home and attributed to particular units of business in the same direct and obvious way in which, for example, leather can be traced to the shoes that are made from it. And most of the real problems involve one other fact; namely, that an increase or decrease in output does not involve a proportionate increase or decrease in cost. There is a deal of complexity in the attempts that are made to trace the untraceable costs or to assign them on some rational basis, or to discover the true added costs of added business, but at the bottom of most of these complexities lies a fact that is simple. That fact is unused productive capacity, or capacity of which full advantage is not taken. "Idle overhead," that great industrial sin, is simply the expense side of this unused capacity. Our study of overhead cost will be largely a study of unused powers of production.

2. EXPENSES OF PRODUCTION UNDER HANDICRAFT OR DOMESTIC SYSTEM

The entire idea of expenses of production is, in a sense, a rather recent one. The medieval handicraftsman had occasion to count the cost of his materials, and the merchant the outlay for his wares, but his own time he did not pay for, and it was not thought of in terms of expense, in the modern business sense. With the coming of the wage system, labor became an expense of production, paid out by the entrepreneur to someone else. More particularly with the domestic system, the employer paid the worker not merely for the latter's time but also for the use of his tools and of the premises where he worked.

The employer's chief investment was in the materials, so that virtually every element which economists now think of as an expense of production was paid for in such fashion that each item could be directly charged to an item of product. In these very special circumstances, expenses were virtually all traceable directly to units of product, and overhead expenses were virtually non-existent. From the slowness with which economic science has assimilated the facts of overhead expense, one is almost tempted to conclude that its prevalent ideas on expenses of production date back to the domestic system and are not really appropriate to any later stage of industrial development.

3. DISCRIMINATION NATURAL

Our system of trade is a surprisingly artificial thing, in that it is built upon habits and conventions which are, many of them, quite recent and which may, many of them, prove to be quite temporary. In the same way our economics may be said to be artificial, in that it is often tempted to regard these customs and conventions as laws of nature. One custom of this sort is the custom of selling goods to all customers at the same price. And akin to it is the economic doctrine that in a competitive market there can be but one price for one commodity at one time, and the further notion that the prices of individual commodities are governed and definitely determined by their individual expenses of production under a competitive system. If one looks at the matter historically, one sees that this has never been an accurate or adequate description of things and that it has been approximately true only for a limited period, beginning with the breakdown of medieval guild restrictions and ending with the growth of industries using large fixed capital. And this is but a minute fraction of time in the history of the human race and includes only the brief infancy of industrialism.

Even within that period, discrimination in prices has been an ever present fact, and, far from being a violation of any natural economic laws of competition, it is one of the natural forms which competition takes. As for the proposition that under competition there can be but one price in a market, in manufacturing industries there is much stronger ground for holding that under competition there must be, chronically or at least intermittently, two different prices in the same market. Without this it would be difficult or impossible for competition to do its supposedly natural work of ironing out profits and bringing prices and expenses of production together.[1] Some commodities are so standardized and are sold in such well-organized markets that differences in price are very nearly eliminated. But even with such commodities as steel and oil there are differences that are important, small though they may be.

Discrimination is the natural and universal mode of trade in countries which have not reached a stage of modern industrialism. It prevails everywhere in the Orient and to a less extent in Europe, although the American one-price system is spreading and there are stores in Japan and China where one is informed on entering that this is a one-price store. The information is very much needed, because without it no self-respecting customer would think of paying the price asked and no shopkeeper would have anything but contempt for the customer who did so. The practice of the art of negotiation furnishes the chief interest of the game to traders of this type and it is virtually as old as trading itself.

The economics of it is extremely simple. The goods, for the most part, are not definitely standardized. The customer does not know whether he is being charged more or less than the market price, because there is no market price. It is contrary to the ethics of this kind of trading to go around openly pricing goods in several shops. As for the merchant, he knows what he actually paid for his goods, and he has his living to make. If he sells goods, they must ordinarily bring in more than he actually spent for them, but his need of an income to cover his living expenses goes on whether he makes many sales or few or none. If he could be made to understand the modern economist's idea of cost as a reward that must be paid in order to secure the service of manager, laborers, shop and wares, he might discover that his own time, or his own subsistence, constitutes an overhead cost, chargeable to his entire business but not chargeable to any particular sale. However, not having the advantage of contact with modern economics he continues to carry on his trade without burdening his mind with unnecessary philosophizing as to economic reasons for his policy.

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[1] This point will be taken up in a later chapter.

If a particular customer happens to know the market well, he will generally get lower prices than one who does not, because he will get the full benefit of such competition as exists. Other customers will be more in the position of purchasers dealing with a monopoly.

With this system of price discrimination, based upon an unanalyzed element of overhead cost, organized economic thinking seems to have been continually at war, at least down to the last quarter of the nineteenth century. Among the ancients the value of a commodity was thought of as an intrinsic thing, so that a transaction was either at the value of the commodity or above or below it, and this lent itself to the idea that if one party gained in a trade the other necessarily lost. In medieval times it was accepted doctrine that all sales should be at a just price and a just price was commonly thought of as that which would furnish an income to the craftsman or trader sufficient to maintain him in a customary and fitting way, suitable to his station in life. It would cover his customary "overhead charges." It is somewhat doubtful how effective the machinery of regulation was in practice, whether on the part of guilds or of national governments, in controlling the actual levels of prices, but it seems probable that it had considerable effect in preventing isolated transactions from being made at prices far removed from the market. It undoubtedly acted strongly in the direction of a one-price system.

4. GROWTH OF THE ONE-PRICE SYSTEM

Modern trade followed the practice of discrimination, though perhaps spending less time on the maneuvers of negotiation than the merchant of the oriental bazaar. Stores grew in size and the selling was done by hired clerks. The owner could not generally trust either their knowledge of the goods, their shrewdness, or their devotion to the profits of the business sufficiently to delegate to them the diplomatic responsibilities of old-style bargaining. Prices were marked on the goods, but in cabalistic ciphers, and the salesman's discretion was guided and limited, but not eliminated. Finally came the now-familiar system of marking goods in plain figures so that customers could tell what the price was without asking the salesman. This practically coincided with the development of large-scale retailing and its economies were obvious.

It took less time to make a sale and thus enabled more sales to be made, and it required less talent and knowledge of the business on the part of the salesman. Nowadays, in stores that do not stick to one price the price is often still printed in plain figures, and the salesperson will call in the manager if it becomes necessary to accept something lower in order to make a sale. Thus the one-price system means a saving in overhead costs. However, far from bringing overhead costs into prominence it tends to take care of them automatically by apportioning them equally upon all commodities, or at least upon all units of a single commodity. Manufacturers and wholesalers, to be sure, do not generally follow this policy, but their discriminations appear to have been prevailingly regarded as imperfections of the market and exceptions to economic law, rather than as natural phenomena whose laws are economic in character and demand study by the economist.

5. SOME EARLY REFERENCES TO OVERHEAD COSTS

One special case of overhead costs, indeed, was noted by John Stuart Mill under "Some Peculiar Cases of Value."[1] In the case of joint products, competition tends to bring the entire income of an industry down to cost, but the relative prices of the different products are whatever may be needed in order to take them off the market in the same relative amounts in which the joint process turns them out. This case is dismissed in a brief postscript to the general theory of value, and the reader is left to assume that these are the only cases in which cost of production (or custom)[1] is not an adequate explanation of the prices of particular commodities. Under unimpeded competition there cannot be two prices in the same market. "Yet every one knows that there are, almost always, two prices in the same market. Not only are there . . . . cheap shops and dear shops, but the same shop often sells the same article at different prices to different consumers."[2] Such prices, Mill said, were the result of custom rather than of competition, and since it is only by virtue of competition that economics can be a science at all,[3] such practices are exceptions to law.

---

[1] *Principles of Political Economy*, Book III, chap. xvi.

Other writers of this period besides John Stuart Mill gave some notice to the facts of overhead cost: notably Torrens, Senior, and Karl Marx. Torrens said, in 1834:

> It is self-evident that, amid the ebbings and flowings of the markets and the alternate expansions and contractions of demand, occasions will constantly recur in which the manufacturer may employ additional floating capital without employing additional fixed capital. . . . . if additional quantities of raw material can be worked up without incurring an additional expense for buildings and machinery.[4]

Senior notes that:

> There are certain expenses upon a mill which go on in the same proportion whether the mill be running short or full time, as, for instance, rent, rates and taxes, insurance against fire, wages of several permanent servants, deterioration of machinery, with various other charges upon a manufacturing establishment, the proportion of which to profits increases as the production decreases.[5]

---

[1] *Principles of Political Economy*, Book II, chap. iv, sec. 3.

[2] *Ibid.* (Ashley ed.), p. 246.

[3] *Ibid.*, Book II, chap. iv, sec. 1.

[4] *On Wages and Combinations* (London, 1834), p. 63. Cited by Carl Marx, *Capital*, I, 443.

[5] *Report of Inspectors of Factories*, October 31, 1862, p. 19. Cited by Marx, *Capital*, I, 443.

The large amount of fixed capital "makes long hours of work desirable,"[1] and with increased use of machinery, "the motives to long hours of work will become greater, as the only means by which a large proportion of fixed capital can be made profitable." Karl Marx did not fail to note these damaging admissions and use them against the system of private industry.

But the effect of overhead cost on hours of labor is not so simple as these writers supposed; witness Lord Leverhulme's argument that a six-hour day with two shifts is more profitable than one eight-hour shift, if only the overhead costs are heavy enough! Even where plants work all night, this policy is not generally traceable merely to the attempt to economize on overhead. The most characteristic and disturbing features of overhead costs are concerned with other issues and had not yet come into prominence at the time of Marx and J. S. Mill. The Industrial Revolution was so strangely slow in making men aware of what it was doing to them!

Yet the substitution of machine for hand labor meant nothing less than the introduction of a new species of creature, which rapidly became the dominant personality in industry, especially in the actual physical work of manufacture and transportation. Formerly the laborer was the central figure; he worked according to the laws of his being and his tools worked as he required their services. Now the machine is the central figure, and labor follows the laws of the machine's being and works as it requires his services.

6. MACHINE VERSUS MAN: HOW THEIR COSTS BEHAVE

Perhaps the fundamental trait of the human laborer is an elastic sort of stability without complete uniformity. He builds on a foundation of habit and custom, yet he seldom or never does things twice exactly alike. He has many and varied capacities, demanding varied activities to develop him into a healthy being and keep him so. He turns naturally from one thing to another: therefore when he does one thing he sacrifices something else he might be doing. This fact underlies the cost of any one kind of work, or the cost of work in general, as over against leisure and the pursuits and enjoyments which it makes possible. Having learned one way of doing a thing the human worker tries variants on it, sometimes with a purpose and sometimes aimlessly, but always following the bent of "monkeying," which has put him where he is, at the head of the animal kingdom and has given him his godlike powers of knowing and transforming the world in which he lives. He is very imperfectly adapted to continuous toil and when he does work he works, now faster and now slower, with an irregular rhythm of which he is himself often unconscious, but which characterizes all organic nature. Especially when working for a purely collective end, his ardors, while often strong, appear to be characteristically intermittent and unreliable. As a class, he needs personal incentives to work—rewards for good performance and penalties for bad—more immediate and substantial than his share in the welfare of the whole industry or the whole community. In many cases, he seems to need the fear of losing his job to make him do his best. And he is, under our social system, a free being, responsible for his own continuous support and that of his family; hence his maintenance is his own burden and not an obligation of industry, except so far as he can exact wages that will cover it.

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[1] *Letters on the Factory Act* (London, 1837), pp. 11–13. Cited by Marx in the same passage as the former quotations.

Contrast with this picture that of the machine. A mere piece of property, incapable of maintaining itself; its maintenance falls, therefore, on its owner, as a "constant cost." Its work is not affected for better or for worse by the compensation paid for it: it does not need the incentive of a piece-wage system nor the fear of discharge to make its wheels grind with their utmost power and speed. It needs no incentives—only maintenance. Because of this moral superiority the person who furnishes the funds to buy the machine can get his reward as a guaranteed stipend or as a share in the collective earnings of the enterprise, and the machine will do just as good work as under any other system of payment. Yet if this were done to labor, at least in its present stage of development, all but the best laborers would be more or less demoralized and discipline and output would suffer.

This mechanical slave has absolutely none of labor's thirst for variety. Uniformity is his passion; continuous operation his religion. He is tireless: his capacity limited only by the hours of the day. And if any of it is not used it is lost: he cannot fill his idle time with side-occupations. Viewed as an animal he is one whose instinctive inheritance prescribes every act of his life. Minor changes in patterns of behavior require a surgical operation; major ones require that he be born again. Hence he yearns to specialize and to turn out indefinitely large quantities of his specialty.

For all these reasons the machine's costs behave differently from those of labor and follow different laws. In the first place, they are "overhead costs" in a much more definite sense and in a much more visible way. Secondly — and this is more important —they fall on industry as constant charges instead of being translated into a variable charge proportioned to services rendered: a system which would leave the individual investor to bear his ultimate burdens in the same way in which the laborer now bears his.

7. OVERHEAD COSTS ON RAILROADS

However, this fact did not have its full effect until the largest mechanical unit of all—the railroad—had reached maturity and had had its transforming effect on industry, making possible the fullest development of mechanical production in other lines by enabling the output of mammoth plants to find a market. There resulted the struggle for world-markets, cut-throat competition, discrimination, the modern forms of the business cycle, and the growth of monopoly. But it was the railroad itself that first brought the notion of overhead costs into real prominence with economists. When railroads were new, their rates were commonly uniform or nearly so, based on weight and distance, and were uniformly high. Soon it was discovered that additional traffic could be carried at little or no additional cost and that reduced rates, if confined to classes of traffic not already moving, would increase the net earnings of the company. Thus classification was born and the foundations were laid for cheaper railroad carriage than would ever have been possible without discrimination.

Along with it or after it, however, came many other less innocuous types of discrimination, often without rhyme or reason, and harmful even to the roads that used them. Rate wars and receiverships followed. Shippers at local points saw goods hauled past them to junctions beyond at lower rates than they paid for their shorter hauls, and with simple logic reasoned that if the lower through rate was adequate, the higher local rate was obviously extortionate. Under pressure of contending interests, with the need of justifying practices against attack, the theory underlying discrimination became vocal and explicit, and the world learned that railroads were different from other industries because such a large part of their costs were "constant" or independent of traffic.

Thus the world of economic thought was made aware of a fact which is older than railroads, older than economic science and, far from being a peculiarity of one business or of a group of highly capitalistic businesses, is universal. From the present point of view, the thing that seems more in need of explanation is why economists should have thought that other industries were different from railroads or why they should have thought that they had explained the prices of single goods by showing that they tended, under competition, to cover the expenses of production.

So far as railroads were concerned, the chief use made of the notion of overhead costs was to justify discrimination as a general practice, on the ground that added traffic was not responsible for those costs which did not increase as traffic increased, and that in any case it was impossible to determine the proper share of costs traceable to one shipment or one unit of business.[1] Some attempts were made to estimate in figures the relation between traffic and cost; the question being framed in the form: "What percentage of railroad expenses are constant and what percentage variable?" The common conclusion was that about half the operating expenses were variable and everything else, including taxes and all return on capital, was constant.[1] As for the fact that increased traffic demanded increased investment of capital in equipment of all sorts, this was recognized in varying degree by different writers, but was never thoroughly harmonized with the formula of constant and variable cost. The upshot was that the makers of rates were assumed to know their own interests, and while it was clear that no one in or out of the railroad business knew the "variable cost" of any given class of traffic, it was assumed that the facts of cost justified wide discriminations, and the practice of "charging what the traffic will bear" was given the benefit of the doubt so far as cost was concerned. The question of distinguishing fair from unfair discrimination was left to be argued on other grounds.

---

[1] On the other hand, as early as 1850 Dionysius Lardner, in his *Railway Economy*, worked out an elaborate system of allocating overhead costs.

8. OVERHEAD COSTS IN OTHER INDUSTRIES

It soon became evident that railroads were not the only industry using large fixed capital and subject to the "peculiarities" of constant and variable costs. It also became evident that discrimination was not the only untoward result of such a condition. Rate wars on the railroads often abolished the regular classifications and brought all rates to a level far below cost. Large companies, railroad and industrial, failed, were reorganized, and continued in business, often more formidable competitors than before. It became evident that economic law did not insure prices that would yield "normal" returns on invested capital, because the capital could not get out if it wanted to, and so had to take whatever it could get. The business cycle had become a recognized part of the order of things, with its recurring periods of excess producing capacity, during which active competition tended to lower prices until even efficient concerns could make little or no return on their investment. "Cut-throat competition" was seen to be a natural thing, and it was seen to be equally natural that business should adopt protective measures, whether combinations, pools, gentlemen's agreements, or a mere sentiment against "spoiling the market."[2]

---

[1] Cf. Ripley, *Railroads: Rates and Regulation* (1921), chap. ii.

[2] Alfred Marshall, *Principles of Economics* (6th ed.), p. 375.

9. HADLEY'S SUMMARY OF THE PROBLEM

A. T. Hadley expressed these tendencies with remarkable compactness in the following passage:

> The investment of fixed capital described in the preceding chapter has wrought much more radical changes in manufactures and transportation than in agriculture. . . . .
>
> Each producer can extend his output with a gain rather than a loss in economy. If he can increase his sales, there will be only a slight increase—perhaps none at all—in the expense for wages and materials, and a decided decrease in the share of the charges on fixed capital which each unit of product must pay. There is no fixed standard of cost which we can treat as the normal price; for the cost per unit of product depends on the quantity sold, falling as sales increase.
>
> The price which will induce new competitors to enter the field is also much higher than that which will lead old ones to withdraw. No concern will quit competition as long as it can pay an appreciable part of its interest charges. It is better to lose part of your interest on every piece of goods you sell than to lose the whole of it on every piece you do not sell. As long as the price received more than covers the expense for wages and materials, each of the old factories will continue to compete. Even if it changes ownership by foreclosure it will remain in operation. But, on the other hand, no new competitor will be called into being unless the price is high enough to afford a liberal profit, after paying interest, maintenance, and other charges on fixed capital invested under modern methods. Thus prices, instead of constantly tending to gravitate toward an equitable figure, oscillate between two extremes. The rate of production, at figures which give a fair profit, is usually either much larger than the rate of consumption, or much smaller. In the former case, prices are unremunerative and unjust to the producer; in the latter case, they are oppressive to the consumer. The average price resulting from such fluctuations may perhaps be a fair one; but the wide changes of price are disastrous to all parties concerned.
>
> . . . . In some cases the industrial units which are necessary for proper utilization of labor have become so large as to produce actual monopoly. . . . . Even in cases where the necessity for concentrated management is not quite so marked, ... the competition of different concerns always involves a loss, from the need of maintaining too many selling agencies, the expense of unnecessary advertising, and the lack of proper utilization of fixed capital.[1]

Here we have an array of problems, primarily relating to the economist's search for the laws governing normal and market price and to the question whether competition is natural and can endure. If monopoly is natural and if competitive price tends to no definite level, much of one's old economics needs revising. The "cost of production to the marginal producer" no longer governs value, for the most expensive production is practically always being carried on at a loss.[1] And if the "marginal cost" of production means the additional cost of additional output in a plant working at part capacity, it does not cover return on investment and may not cover all of operating expenses. The idea that price is governed by marginal cost of production may be reduced to a tautology; the marginal producer is the producer whose cost of production is equal to the normal price.

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[1] A. T. Hadley, *Economics* (1896), pp. 151–54.

Alfred Marshall avoided a barren tautology by making his theory hinge on the expenses of production of a "representative firm" which has gained the chief economies of large-scale production.[2] J. B. Clark considered that the force of competition was continually driving prices toward the cost of production of the most efficient concern, at a speed governed by the rapidity with which its processes could be imitated or its own plant could expand,[3] though he also noted the importance of the variable costs of inefficient producers.[4] The goal would never be reached because it was itself in motion. Still more recently, during the world-war, the statistics of costs gathered to guide the work of regulating prices yielded the idea of "bulk-line" cost, so selected that the bulk of representative producers are below it and only a sporadic 10 or 15 per cent are above it. These last may be chronically inefficient, or may have had accidents which render the year in question a peculiarly bad one for them. The figures gathered in the war years do not necessarily represent the law of competitive price in undisturbed times but they represent a type of study which may give the law a definiteness that is much needed, especially since it became evident that production can continue indefinitely even though "overhead costs" are not covered.

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[1] "Cost" is here understood to include interest on all capital invested, in harmony with the usage of the economic theory we are discussing. The various possible meanings of cost will be examined in chap. iii.

[2] Marshall, *op. cit.*, esp. p. 343.

[3] J. B. Clark, *Essentials of Economic Theory*, pp. 286–87, and chap. xxi, esp. p. 369.

[4] *Ibid.*, p. 288.

10. THE CONTRIBUTION OF COST ACCOUNTING

In the meantime business has developed the technique of cost accounting, including methods of allocating costs which cannot be directly traced to given units of product. This may be confined to seeing that all products are charged with a share of all operating expenses, or it may also include a share of interest on investment. This obviously offers great possibilities in the way of developing a standard of sound or conservative practice in fixing prices, which will act as a check on cut-throat competition. It also offers great opportunities for the development of arbitrary and fictitious notions of cost, through the necessity of apportioning items somehow, even if there is no satisfactorily scientific basis on which to do it. And of course the critical point is, after all, what the management does with the figures after it gets them; what use it makes of them in the actual fixing of prices. Cost accounting is still in a formative stage, though it has already developed a voluminous literature, and its vocabulary gives it at least one of the characteristics of science—that of being inscrutable to the uninitiated. Perhaps the most promising sign of development is the beginnings of true statistical method in the use of cost-accounting data.

11. DEVELOPMENTS IN PUBLIC UTILITIES

Other important developments have occurred in connection with public utilities, especially, perhaps, the business of furnishing electric current. Here, for the first time, organized technical attention is paid to the recurrent ebb and flow of output and the daily and seasonal "peaks" of demand. The sagging of demand at off-peak hours represents waste in the form of unused productive capacity, or "idle overhead." The interest on the capital investment is mostly independent of output actually produced, and is governed by the output the plant stands ready to produce. This is a cost, then, which off-peak business need not pay in order to be worth taking. The problem of policy involved is twofold—to stimulate off-peak business in various ways and so improve the utilization of the plant, and to apportion justly the burdens that do not vary with output. Here again, as in the case of cost accounting, a body of technique has developed, with a considerable literature and a special vocabulary.

Here, for the first time, we find price policies based on overhead cost being worked out by definite mathematical formulas so that their differentiated rates lay claim to be scientific, not merely qualitatively, but quantitatively; and correct, not simply in the general character of the discriminating charges, but in amounts as well. This, and the recognition that fluctuations of output involve "idle overhead" in the shape of waste productive capacity, are the two big contributions of the public service industries to the general development of the economics of overhead costs. This idea of peak loads, and of waste through irregular utilization, has come to apply to practically every industry in some form or other. Restaurants, theaters, golf clubs, garment-making industries, railroads and street cars, building, and other trades—all have their peaks, daily or seasonal. And all industries suffer in common from the unpredictable irregularities of the business cycle.

12. LABOR AS AN OVERHEAD COST

Once the holding of unused productive capacity is conceived as "idle overhead," it was inevitable that the idea should be extended to human powers as well as to the powers of physical plant and machinery. G. P. Watkins, in discussing the load factor (ratio of average output to maximum output) includes a discussion of the load factor of labor, indicating that the waste involved is as real as in the case of capital.[1] Wherever a laborer has invested time and money in specialized training, the result is, in a certain sense, fixed capital which is useful in one occupation and in no other, and which must earn whatever return it can, because the investment cannot be withdrawn and moved into some other line of business. In such a case it seems fairly clear that labor involves an overhead cost.

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[1] G. P. Watkins, "A Third Factor in the Variation of Productivity," *American Economic Review*, V (December, 1915), 753-86.

In a more general sense, however, there is a minimum of maintenance of the laborer's health and working capacity which must be borne by someone, whether the laborer works or not: that is, if it is not borne, if the maintenance is not forthcoming, the community suffers a loss through the deterioration of its working power which is at least equivalent to the cost of maintaining the laborer. Thus the burden is there in any case: it cannot be avoided. From this point of view it appears that a large part of the cost originally counted as wages represents an overhead cost which the laborer is responsible for covering as best he can, just as the employer is responsible for covering the overhead cost on account of capital. However, if the laborer fails to cover it the community does not escape the burden, and it is ultimately borne by industry in the shape of reduced productive power and damaged morale. And thus it comes back to the employer in any case. There are other features of the human cost of labor corresponding to some of the particular phases of overhead costs in connection with large fixed capital, but they may be reserved for more detailed treatment later.

If this last step is taken, overhead costs are seen to be a universal fact. The reason why the expenses of production, some of them, normally vary in proportion to output is simply because the terms of the wage contract are drawn in that way. The employer leaves the wage-earner to care for his own overhead and the terms of the contract are not scientifically adjusted as, for instance, the contract for electric current is sometimes adjusted, to the overhead costs of the ultimate producer. It may be that we shall find that our general system of wage payment is thoroughly unscientific and that a more scientific system may operate to improve the steadiness of employment in much the same way in which scientific rate systems have been used to increase the regularity of use of electric power plants.

The foregoing brief sketch of the development of the idea of overhead costs indicates that it is a thing of many different aspects. Before plunging into the mass of detail which these various aspects involve, it will be worth while to take a brief survey of the field and gain a general view of the range of prob-

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CHAPTER II

THE SCOPE OF THE PROBLEM

SUMMARY

Value and cost the test whether business is economically self-sustaining, 17—Complications introduced by overhead costs, 19—Conservative versus radical views of depression, 19—Is labor an overhead cost to society? 20—When to count overhead costs and when not, 21—Different dimensions of business, 22—The paradox of overhead costs, 23—The business depression and cut-throat competition, 24—Size, specialization, and integration, 24—Shifting and conversion of overhead costs, 25—Private versus social accounting in time of depressions, 27—Insurance as a conversion of variable into overhead costs, 30—Is the argument dangerously radical? 30—Problem of assessing and collecting overhead costs, 31—Principle of incentives modifies older ideas of fairness, 33—Conclusion, 34.

1. VALUE AND COST THE TEST WHETHER BUSINESS IS ECONOMICALLY SELF-SUSTAINING

The backbone of the science of economics is the balancing of value against cost. This sets up a test by which to judge any activity—the producing of any goods or the rendering of any service—in order to prove if it be economically self-sustaining or no. Other activities may be worthy, charitable, public-spirited, even vitally necessary to the public welfare or the public safety, but they are not paying business and they are often thought of as a variety of poor relations; dependents which must, in one way or another, be supported by business which does pay. People are inclined to think of such things as not economic activities at all. They are often very nice things to have, but they are not part of the problem of Economic Efficiency.

Economic efficiency consists of making things that are worth more than they cost, and it is the peculiar characteristic of private business, under a competitive system, to seize and exploit any opportunity to achieve this desirable end. Thereby—so runs the argument—it tends to produce as much of everything as can be produced without driving value below cost, and any more would not be economically worth producing.

For example, if people undertake to make more automobiles than other people will pay for, the automobile business will become unprofitable, and the surplus of people and resources that were making automobiles will look for something else to do for which people will pay. Ultimately, after some possible tribulations, they will find their way into house-building or the moving-picture business or something else for which there is an adequate demand. Thus they are placed where they can do the most good—economically speaking. If a business cannot make a profit, that is a sign that some of the resources it utilizes are not in the right place.

This idea that production must cover its expenses in order to justify itself is also applied to times of business depression, when output is curtailed because it would involve a loss to keep the wheels moving at their regular speed. In this case it is difficult to say that labor is thrown out of work because it is not in the right place and should have gone elsewhere, because virtually all industries suffer from the same disease at the same time. For the present, at least, there is no "elsewhere" to go.[1] This being the case, the losses of producers cannot exactly serve as salutary penalties, to spur misjudged people into the right avenues of usefulness; they merely prevent things from being produced when there is no "adequate market" and the goods would not be worth what they would cost.

But what is the cost of goods, under such circumstances? Not of goods in general but of particular additional supplies that might be produced if the market only permitted? What does it cost the railroads to haul a carload of lumber to market, or the half-idle car manufacturers to make a car to haul next year's lumber, or the steel plants to make the steel to make the car, or the mines to mine the coal to make the coke to smelt the steel, or what would it cost the miner, sitting idle in front of his shack or filling in the time with incidental gardening, to go into the mine and get the coal out? What is the cost of anything, at any time? The instant we try to give a thoroughgoing answer to such a question we find ourselves perplexed by the existence of "overhead costs."

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[1] Since writing the above I note that it is borne out by Professor W. I. King's analysis of employment in the depression of 1921. He finds that there is very little shifting from one employment to another. See *Employment Hours and Earnings in Prosperity and Depression*, New York, National Bureau of Economic Research, 1923, esp. pp. 25–28.

2. COMPLICATIONS INTRODUCED BY OVERHEAD COSTS

To put it briefly, the costs we can trace are only a part of the costs of the business as a whole, which it must somehow manage to cover. What now has become of our rule of economic efficiency? Is the carload of lumber worth carrying if it covers all the cost that can be attributed to that single carload? Or is it only worth carrying if the railroad as a whole is covering all its costs, and what are they? Shall we count the costs that would keep on even if the railroad shut down entirely? Evidently "cost" is an ambiguous term and the test by which we are accustomed to decide whether production is self-sustaining or not has lost its meaning and requires a thorough re-examination.

3. CONSERVATIVE VS. RADICAL VIEWS OF DEPRESSION

Such a re-examination throws a most interesting light on the timeworn dispute over the interpretation of what happens in time of business depression. One group says that at such times production cannot be carried on because it will not cover cost, and appears to acquiesce in this accounting, while regretting the obvious evils that result. The other group finds food for satire in people going without overcoats because too many overcoats have been made, or sleeping on park benches because of an "overproduction" of houses. They speak of makers of shoes, clothes, and other things who are suffering for lack of each other's products and who could perfectly well enter the empty factories and make them for each other, but are prevented because the capitalist owner exacts his toll of exploitive profits.

The issue is partly one of fact and partly one of interpretation. The defender of things as they are points out that, even if the return on the capitalists' investment be labeled "exploitation," there is no set minimum of such exploitation that is always protected in time of depression; and that in point of fact businesses often operate without yielding any return on investment at all. This is relieved of the taint of charity by pointing out that return on investment is an "overhead cost" which goes on whether the business operates or not, so that the owners are no worse off if they operate and do not earn it than if they stand idle and do not earn it.

This last argument, however, is a risky one to use, for the same thing could be said of many of the operating expenses as well as of the return on investment. If it is good economy to operate a business without any return on investment, because the return would be lost just the same if the business shut down, is it not also good economy to operate at less than no return on investment, if the deficit is no greater than the operating expenses that would go on even if the business suspended operation? Is it not good social economy to produce at an absolute financial loss rather than not at all? Some businesses have doubtless done just this at such times, but it is common knowledge that managers do their best to maintain net earnings and that, whatever they might do if it became a question of avoiding a complete shutdown, they begin submitting to moderate curtailment of production long before net earnings disappear. Thus it appears to be generally true that production is curtailed while its value is considerably more than the cost specifically traceable to it.

4. IS LABOR AN OVERHEAD COST TO SOCIETY?

So far, the facts seem in part to justify the socialist critic of the existing order. But there is more to the story. Suppose the product cannot be sold for enough to cover the price of the materials and an ordinary living wage for the labor. It can still be argued that even this minimum financial expense is an exaggerated measure of the social cost of producing goods *when the alternative is to let some of our productive power go irrevocably to waste.* Wages are supposed to measure the personal sacrifice of toil for the laborer, but in this case the wages paid represent no personal or social cost whatever. Putting idle labor to work involves no "cost" to the laborer, unless idleness has already ruined his character. The "personal sacrifice of labor" means something for some purposes, but in relation to this problem it is meaningless. Offer a man the same pay whether he works or not, and he may prefer to be idle, though most men would wish to do some useful thing. But *industry does not offer this happy choice.* Involuntary idleness and the hunt for a job is so much worse than any personal sacrifice of normal and healthy labor, that by comparison the labor is good and not an evil.

It comes down to this, that any use of labor that is worth anything at all is worth that much more than nothing. In that respect the socialist view of business depressions is correct and any rebuttal that attempts to explain away this fact by the reckonings of financial expenses is a bit of economic sophistry.

5. WHEN TO COUNT OVERHEAD COSTS AND WHEN NOT

Should we, or should we not, count "overhead costs" in deciding whether a given thing is worth producing? There is no universal answer: no formula by which all cases can be settled in advance. However, in a general way the rule is: whenever a policy is being considered which will involve "overhead expenditures" that could otherwise be avoided, they are part of the cost of that policy; likewise, when we are comparing two policies, each of which involves its own overhead, each should have its own overhead charged against it; but whenever we are choosing between two policies under both of which the same overhead outlay will have to be met, that overhead outlay is not a part of the cost specifically traceable to either policy. For instance: in comparing waterways, railroads, and automobile highways as methods of freight carriage, wherever it is a question of building more of one or the other, or spending money to enlarge the capacity of one or the other, or even of maintaining them rather than letting them go out of use, there is an overhead outlay involved and it is a mistake not to include it. The fact that highways charge no tolls to cover maintenance or interest on highway bonds, while railroads have to cover maintenance and interest, and pay taxes besides—this raises a real question of fairness and efficiency which is important, but beyond the scope of the present chapter.

Moreover, in reckoning overhead on highways it is not altogether simple to say what it is due to. The strength and cost of a modern motor route are related to the loads it is designed to carry. These outlays are chiefly chargeable to the heaviest motor-truck traffic: that which actually requires the full strength which has been given to the foundation of the road, or still more, the overloaded trucks that exceed the capacity of the road and break it down prematurely.

The motor-truck operator may economize his overhead by making one truck do the work of two, but his saving may be negligible compared to the cost he imposes on the community. The cost of a given road might not increase perceptibly with a 10 per cent increase in the number of three-ton trucks running over it, but it might leap upward if that same 10 per cent increase in traffic were handled without increasing the number of trucks, by making 10 per cent of them twice as heavy. This represents a very real waste, with which the highway authorities are beginning to grapple, but so far they do not have the traffic data necessary to an adequate knowledge of the facts. Railroads do not exhibit the same difficulty, because costs of haulage and of maintenance come out of the same budget, and strength of roadway and weight of rolling-stock are planned as parts of one program.

6. DIFFERENT DIMENSIONS OF BUSINESS

A little study of this everyday instance will serve to show something more about overhead costs. Costs have more than one way of responding to increased business and business has more than one dimension. It is necessary to distinguish the cost of increasing the capacity of a highway; the cost of carrying more traffic which is within the capacity of the existing highway, and the cost of carrying a given traffic in different sizes of truck loads. In none of these cases will cost vary exactly with volume of business, except by accident; and in each case there will be a residuum of untraced cost, but it will not be the same residuum in the three cases. Evidently, when we undertake to study how cost varies with varying output, we must differentiate between one case and another, or our results will be wholly meaningless.

7. THE PARADOX OF OVERHEAD COSTS

When it comes to making use of the facts of overhead cost in the attempt to promote the fullest utilization of our equipment of productive resources, there arises the paradox of price. This runs as follows: if any business that would pay its own particular costs is refused because it will not pay its share of overhead, there is a loss. Yet prices must be charged which will cover the overhead, so long as industry depends on private enterprise. There is only one answer to this dilemma—discrimination. The overhead costs must be levied on such parts of the business as will stand the burden, while other parts of the business, which cannot otherwise be had at all, are charged whatever they can pay, regardless of overhead costs. However, this is only a partial answer to the question, and creates more problems than it solves.

To keep discrimination from degenerating into sheer favoritism there should be some objective standards to follow. In many cases business divides itself naturally into classes which can be made the basis of differential charges without personal favoritism. In the case of joint products the practice may go no farther than fixing the prices, for example, of dressed beef, hides, and other by-products in such relation to each other that no parts of the steer will be wasted, and this can hardly be called discrimination at all. Or a special class may be made of business that comes at times when the plant is not fully occupied. The night rates on telegrams and long-distance telephone calls are examples of rates to develop this "off-peak" business. Or special rates may be made for large orders, long hauls, or other specially economical varieties of traffic, often involving the fact that there are some costs that are traceable to particular orders but do not vary with size of order, length of haul, etc. Even where rates are based upon such objective criteria they may still be unfair as between classes of business. Differences, real or imaginary, in the quality of different grades of goods, may be used as pretexts for discrimination. Where this happens, or where a business discriminates without any pretext, obvious questions of unfairness arise.

8. THE BUSINESS DEPRESSION AND CUT-THROAT COMPETITION

The business depression presents a case of "off-peak" business which is harder to deal with, partly because it is not predictable and partly because it lasts so long that there are dividends to be earned by this off-peak business, so that if the off-peak business does not cover overhead expenses, they may not be covered at all, and the result will be a general state of cut-throat competition.

This is another of the characteristic results of overhead costs, and it presents a whole array of problems in itself. Fear of such competition may deter possible competitors from entering a business and spur those already in it to form a monopoly, or to come as near it as law and public opinion will permit. And without formal combination, tacit understandings arise and a sentiment is cultivated which regards cut-throat competition as contrary to business ethics. Among other things the growing technique of cost accounting plays an appreciable part in giving definiteness to the line between proper and undue cutting of prices.

9. SIZE, SPECIALIZATION, AND INTEGRATION

Another question involved in this general field of study is the economical size and type of the business unit. Large-scale production affords an opportunity for making more effective use of many services and facilities whose cost is of the "overhead" type. Sometimes, however, this result can be still more effectively secured if these services or facilities secede and become the basis of a separate enterprise, whose customers would include the original enterprise and all its competitors and perhaps many enterprises in quite different lines of business.

Thus the work of advertising has become specialized, and has reached an efficiency which sheer growth of large-scale concerns could never have produced so long as advertising was a mere department of a manufacturing business. This sort of specialization does, however, involve one more process of negotiation and exchange. The advertising concern must advertise and sell its own services and this involves costs, which also must be classed as "overhead." Sometimes these outweigh the advantages of specialization, and then efficiency demands integration. What actually goes on is a continual experimenting with different groupings of functions, constantly testing which of these economies of overhead cost counts for the most in a given case and at a given time. Some of these specialized functions, especially in the general field of research, can be taken over by co-operative organizations or by government itself.

Standardization is another phase of this general process. It means reducing the number of models or sizes and turning out more of each, with a saving in those overhead costs which each separate size or model involves. On the other hand, a selling force can often handle a fair variety of goods more effectively than a "line" that is too narrowly specialized. There is a considerable element of "overhead cost" in the work of buying and selling.

10. SHIFTING AND CONVERSION OF OVERHEAD COSTS

Another subject which presents very real difficulties is that of the discrepancies between the overhead costs of businesses taken separately and those of the industrial system as a whole, or the ultimate personal sacrifices on which the whole structure of financial expenses rests. Some of these discrepancies have already appeared in connection with business depressions. The root of many of them lies in the shifting and conversion of overhead costs as they are passed on from the person who incurs them to his customers. In this process constant costs may be converted into variable, or variable into constant, though the latter change occurs far less often.

For example, the costs of a telephone company are partly constant and partly variable, while the charge to the consumer may be wholly constant (so much per month regardless of number of calls) or wholly variable (so much per call with no reduction for quantity). Or the charge may be a mixed one, corresponding more nearly to the way in which the company's expenses behave. If the charge is constant the user gets added service for nothing although it costs the company something to render it, and there is danger of wasteful use. If the charge is so much per call, then added calls cost the user more than they cost the company, and there is danger of wasteful non-use through shutting off some telephone calls that would be worth more than their special cost but less than the rate charged. Wherever constant costs are converted into variable or variable into constant, there is a stimulus either to wasteful overuse or wasteful disuse of our productive facilities.

Most of the ultimate sacrifices of production have something of the "overhead" quality about them. We have seen that even the time of the laborer does not always involve a sacrifice that could be charged at so much per day without misreporting the facts of the human economy. However, when a laborer does sell his services for so much per day, his employer naturally charges the expense against the value of the day's work. So the cost of labor becomes a "variable expense" by virtue of the wage contract, regardless of what may be the ultimate facts of human cost. In the same way the whole price of materials used is a direct expense, regardless of how much of it may represent overhead costs to the maker of the materials.

One of the stock examples of overhead cost is the cost of using machinery; maintenance, depreciation, and return on investment; but this may become a direct and variable cost to the user of the machinery if he leases it from the owner and pays according to use. Thus the United Shoe Machinery Company, a large and strong concern, took on itself the overhead costs of smaller shoe manufacturers by leasing its machinery to them instead of selling it, thus converting the cost of capital into a variable expense to the shoe manufacturer. The wage worker in a similar way assumes responsibility for his overhead burdens, the chief difference being that he lacks the financial strength of the United Shoe Machinery Company, and cannot bear the burden successfully. Evidently the question how much overhead cost there is in any particular industry depends largely or entirely on the system of contracts under which industries acquire the use of the factors of production. The wage system makes labor a direct and variable cost and the system whereby corporations own their own fixed capital makes that an overhead cost. There are reasons for this system; natural reasons and historical reasons, but it would be quite possible to draw contracts in such a way that labor would be the overhead expense to the employer and machinery the direct and variable expense. In either case, however, the nature of the ultimate sacrifice would be the same. When it is a choice between use and involuntary idleness, the bulk of the ultimate costs of industry are "overhead costs."

II. PRIVATE VERSUS SOCIAL ACCOUNTING IN TIME OF DEPRESSIONS

The implications of this proposition are so interesting that it may be worth while to pause in our survey and look at it more closely. If ultimate costs are nearly all overhead it follows that it would pay for industry as a whole to keep going rather than stand idle, even if the product were worth next to nothing. And yet any serious drop in prices is the signal for widespread slackening of production. Industry as a whole is unwilling to treat its expenses as overhead and act accordingly.

Single enterprises are often willing to disregard their overhead costs in a time of slack demand, though many are always too much afraid of "spoiling the market." But it is not enough for any one enterprise to do this, nor for all the enterprises in any one stage of an industry to do it. The producers of everything they buy would have to do it at the same time, and again the producers of everything that these producers buy, and so on indefinitely, back to the ultimate raw material and forward through every metamorphosis or handling until the goods reach the ultimate consumer. Retailers would have to force on the market goods they had bought when prices were up. Hardest of all, labor would have to do the same thing; that is, be ready to sell its services for whatever they would bring and make up its necessary maintenance—if at all—out of the earnings of better times.

If all acted at once, each one would feel the stimulus to demand resulting from all the price concessions taken together, and it would be very great in proportion to the sacrifice required of each single producer. As it is, each acts by himself and, for the moment, feels only the stimulating effect on demand resulting from the concessions he has made in his own limited field. Perhaps his own personal toll (the margin over which he has control) represents 2 per cent of the ultimate selling price of the goods; perhaps 4 or 10. Only in rare cases would it be as much as 20. He may cut his toll in two, then, without effecting more than from 1 to 10 per cent reduction in the final price of the goods. Here the stimulating effect on demand will be very small in proportion to the sacrifice required. Moreover, labor is in no position to make slashing reductions in its wage demands and live on accumulated savings. Thus it is the part of individual financial wisdom or necessity to protect one's margins and let demand fall off rather than see the margin of net income approach the vanishing point.

This statement does not take account of the possibility of one producer increasing his own sales at the expense of his competitors, so that he is not dependent on increasing the total demand for an increase in his own volume of business. A slight cut in prices might increase his sales hugely (if his competitors did not follow suit). In short, we have ignored the typical tactics of active competition. This omission is largely justified by the fact that genuinely unrestrained competition has, under such conditions, proved so disastrous to the competitors that it has developed its own antidotes in the shape of a sentiment against cut-throat competition and the "spoiling of the market." The actual result, then, is a compromise between actual competition and a spirit of mutual restraint which is essentially anti-competitive in character.

One might contend that there is a conflict here between private and social interest which arises out of the essential nature of private enterprise; in that the social interest requires capacity output at any price as long as it is worth the excess cost of working rather than standing idle, while private interest demands maximum net income above the "variable" costs of operation and strikes a balance between decreased output and decreased margin of earnings. The social interest appears to be on the side of cut-throat competition, which is much the same as inviting competitive business to commit hara-kiri.

However, there is one saving fact. If everybody *stood ready* to cut down to the absolute minimum of "variable cost," and if everybody shared such cuts as were made, *nobody would have to cut that low* or anything near it, in order to restore demand to a reasonably normal level. For the chief cause of falling-off in demand lies in the fact that any unemployment reduces people's purchasing power and so returns on itself in a vicious circle creating more unemployment. If everyone were determined to sacrifice earnings whenever necessary to maintain output, this vicious circle would be broken and the chief cause of shrinkage of demand would disappear. Some primary causes of fluctuating demand would remain, but their cumulative effects would be controlled or eliminated.

Even the knowledge that such a policy could be confidently expected would tend to cure people of expecting depression and, because they expect it, curtailing purchases more violently than sales have actually been curtailed, and so doing their utmost to bring on the thing they expect. This phase of the question is quite like the philosophy of bank reserves. Under the old National Banking Act, a fixed percentage of reserves to deposits was required. If it was not maintained, new loans could not be made, and the banks actually suspended cash payments to protect their reserves, though the maintenance of cash payments was the only thing the reserves were good for—the only thing that made them worth keeping. All of which irresistibly suggests a man on a rock, jumping into the water for fear the tide will rise and wet him.

If all the banks in October, 1907, for instance, could have announced that the time had come to use the reserves for the purpose for which they had been accumulated, and that they would disregard legal requirements as to loans and not suspend cash payments till their vaults were empty of cash, there would have been no suspension and probably no serious strain on the parity between gold and deposits. Similarly, if everyone stood ready to cut prices to the limit to prevent unemployment, no one would have to cut very far. However, it requires more than intelligence and good-will on the part of single competitive banks to make the bank reserves actually available, and it will require something more to make available the reserves of productive power that go to waste in times of depression. It will require some means of common and co-ordinated action not less far-reaching and effective in the industrial field than the Federal Reserve System is in the banking field. And all to overcome evils traceable to the shifting of overhead and their conversion into direct costs in the process!

12. INSURANCE AS A CONVERSION OF VARIABLE INTO OVERHEAD COSTS

Insurance of property is another device whereby costs that vary (though they do not vary uniformly with output) are converted into constant costs. In this case the producer hires the insurance company to take them off his hands in exchange for a constant payment. Here the actual cost varies largely with the owner's vigilance and there is danger of waste through unduly relaxing that vigilance, if not through actual fraud.

13. IS THE ARGUMENT DANGEROUSLY RADICAL?

When once the question is opened of discrepancies between social and business accounting, one cannot stop with costs alone but must at least recognize the existence of certain conflicts in standards of value. For example, are shoes worth less than usual in time of depression because the price is low or are they worth more than usual because people are not so well shod? An embarrassing question for an economist, perhaps, but one that must be faced in any serious study of the economics of the business cycle.

Is the argument here presented becoming dangerously socialistic? That depends entirely on the reader's preconceptions. It does no more than give some increased definiteness to a proposition which most people would admit at once in the abstract: namely, that there are wastes and maladjustments in private industry which a socialistic organization would find opportunity to eliminate, if it could command sufficient intelligence to diagnose the wastes correctly, and sufficient devotion, ability, and hard work to establish the collective type of efficiency without sacrificing the values embodied in the cruder, individualistic type we now have. This involves the devising of a system of social accounting that will work, and work better than our present system of financial accounting.

Most people do not think a socialist organization could succeed in doing these things, while they do think the existing system can be made a more efficient engine for giving the community what it or its members want. Indeed, most people err on the side of too optimistic a faith in the perfectibility of the existing system, if only their pet measures are adopted. However that may be, detailed analysis of discrepancies between social and commercial accounting, such as this study suggests, would be obviously of a great deal more use to a society that is trying to keep the system of private industry and amend its faults than to a system that throws it overboard and starts to build up its organization, and the accounting system that must go with it, out of whole cloth.

14. PROBLEM OF ASSESSING AND COLLECTING OVERHEAD COSTS

But to return to the specific problems of overhead costs. Last, but not least, comes the problem of assessing, apportioning, and collecting them. Among the issues that hinge on this central problem, we have already mentioned the questions of discrimination, fair and unfair, cut-throat competition and restraints upon it, natural versus predatory monopoly, and the development of "off-peak" business, whether the peaks be daily, seasonal, or the irregular peaks of the business cycle.

The problem involves the allocation of certain general burdens where reasonable men may differ as to what is a just apportionment. There is no natural system of prices in the old sense. Cost prices do not mean anything definite any more. Efficiency requires discrimination and discrimination has no universally accepted standard to go by to keep it from degenerating into favoritism. The epigram attributed to Lord Fisher, "Favoritism is the secret of efficiency," takes on a new and far-reaching meaning.

There are four logical bases on which overhead costs may be apportioned. These are: (1) Ability to pay. This puts them in a class with taxes, which represent the levying of governmental overhead costs. (2) Causal responsibility. This is a somewhat elastic term, and the line of development is toward broader notions of what responsibility includes. (3) Benefit or use. This has something to do with ability to pay, and something to do with responsibility. (4) Stimulus to improved utilization. That is, anyone who has an opportunity to do anything to reduce society's "idle overhead" may conceivably be moved to do so if a properly differentiated burden is laid upon him, with a chance to lighten the burden by doing what he can to improve the collective efficiency. Such cases will ordinarily fall under (1), (2), or (3) also. These four principles do overlap in fact, more or less.

For example, the proposal to make the cost of labor in part at least an overhead charge on the employer could be argued on all four grounds, the most decisive question being: Who can take the most effective action to eliminate idleness? And the answer is that the laborer himself, the employer, and government are all so important that neither should be left without an effective incentive to do what can be done, but that the powers and opportunities of employers are probably greatest of the three. The fixing of prices, and wages, becomes in the last analysis a matter of placing these burdens in such fashion that they shall furnish the most effective stimulus to the full development and utilization of the productive powers of the nation. It involves saying that the overhead costs of labor may be laid upon the laborer, or upon the public, or upon the employer as the representative of the industry, in proportion to their responsibility for imperfect utilization or to their opportunty to improve the existing conditions.

15. PRINCIPLE OF INCENTIVES MODIFIES OLDER IDEAS OF FAIRNESS

Such a distribution of burdens may not be in harmony with our traditional ideas of payment or of liability, any more than the modern notion of employers' liability for accidents or of compulsory insurance is in harmony with individualistic ideas of justice. The nineteenth century was accustomed to think it just that anyone should bear the burdens that fall upon him as a natural result of the contracts he has made of his own free will. This principle did not cover contracts made under duress, contracts made by parties incompetent to bargain, or contracts whose effect was to destroy or unduly limit one's liberty for the future. Laws against harmful drugs and dangerous food products, or police regulations covering such everyday practices as the inspection of milk and meat, involve a further limitation on the principle of free contract—the individual is to be protected from mistakes that might do permanent and serious injury to his health and so would cripple his real freedom for the future even though his technical legal freedom might remain unimpaired. Thus the principle of the justice of free contract has never been held without important qualifications. Under it, however, the laborer bore the burden of industrial accidents, industrial diseases, and unemployment—all of them ills of industry as a whole, and all of them due to causes over which the individual sufferer had no adequate control to remove or to minimize them.

With regard to industrial accidents a different idea has already made its way into general acceptance. Accidents are regarded as costs of industry, to be borne by industry to the extent of reasonable compensation, and to make this right of compensation effective the wage-earner must not be allowed to waive it by contract. This system has worked well in two ways. It has lightened the burden of accidents by distributing the loss that used to fall with ruinous weight on a few. And it has created an effective financial incentive to accident prevention, roughly corresponding to the interest the community has in such work of human conservation, and it has placed that incentive where it could do the most good, on the person whose care or neglect can make the most difference to the number of industrial accidents: that is, on the employer.

Of course, the workers are themselves jointly responsible, on account of the recklessness and unwillingness to use safety devices which characterize a part of them, and often endanger their more cautious fellows. These are well-known obstacles to employers' efforts to promote safety in industry. But even from this point of view the education of the worker is best promoted by giving the employer a strong money motive which may save him from becoming too easily wearied of well-doing in this direction. Largely as a result of this new policy, the rate of industrial accidents has been reduced radically in the past twenty years, and an incalculable human and economic gain has resulted.

During the same period the electric light and power companies have enormously reduced their "idle overhead" by improving their "load-factor," bringing average output much nearer maximum and thereby securing a great increase in efficiency. However, during the same period the wastes through unemployment have shown no such improvement. Good-will and a general sense of diffused responsibility have so far failed to produce adequate results.

16. CONCLUSION

There are a number of other problems connected with overhead cost, particularly that of the length of the working day and the status of the slow or inefficient worker. But this preliminary survey is already becoming too extended. The wide range and far-reaching character of the problem are sufficiently manifest, and we may turn to a more intensive and systematic study.

CHAPTER III

THE GENERAL IDEA OF COST AND DIFFERENT CLASSES OF COSTS

SUMMARY

The different standpoints and purposes from which cost is viewed, 35—Absolute versus alternative costs, 37—Direct observation versus differential analysis, 38—Financial outlays of the company versus costs of producing goods, 40—Long-run versus short-run fluctuations, 43—Theoretical omniscience versus working approximations, 44—Operating expenses and fixed charges, 46—Differential and residual cost, 49—Variable and constant costs, first meaning, 51—Variable and constant costs, second meaning, 53—Other meanings of constant and variable costs, 53—"Sunk" costs, 54—Urgent and postponable costs, 55—Direct and indirect expenses and kindred concepts, 56—Joint cost, 58—Manufacturing versus selling expense, 59—Cost in the sense used by cost accountancy, 64—Is interest a part of cost, 65—Cost from the standpoint of different purposes, 67—Conclusion, 69.

PART I. POINTS OF VIEW AND METHODS OF MEASUREMENT

1. THE DIFFERENT STANDPOINTS AND PURPOSES FROM WHICH COST IS VIEWED

The general idea of cost covers a number of different meanings. Especially about the fact of overhead costs there has grown up a bewildering confusion of business and economic terms describing different aspects of it in ways that are sometimes correct and sometimes misleading, and sometimes inconsistent and ambiguous. People speak of such symptoms as "increasing returns," "constant and variable expenses," "direct and indirect costs," "prime and supplementary costs" and "sunk costs," while such terms as "fixed charges" and "general expenses" are used in various ways to describe parts of these costs. Back of this there lies a great deal of controversy as to whether certain items are properly costs at all. Most of this controversy will disappear if we carry our study far enough to recognize that there are different kinds of problems for which we need information about costs, and that the particular information we need differs from one problem to another.

Perhaps the best way to facilitate this is to think of the different people who are concerned with the study of costs in one way or another. There are engineers, general accountants, cost accountants, statisticians, and economists, all with different angles of approach and different purposes to serve. The engineer has to make estimates of cost of construction and operation for different sizes and types of productive equipment, either for a single operation or for an entire plant. He is largely responsible for selecting the equipment and method of production that will yield the greatest total efficiency, or at least he has to furnish the management with the data necessary to make such decisions.

As for accounting, it has many uses, and appears to be in an interesting state of transition, in which the relation of the newer technique of cost accounting to the older general accounting procedure is not fully established. For lack of a better term, we may call this general accounting procedure "financial accounting" to distinguish it from cost accounting, although the two must, for certain purposes, work together and must rest on the same primary records. Financial accountancy is primarily concerned with recording absolute income and outgo, noting every separate bit of either and adding them up into correct totals. It has two underlying and elementary purposes which are probably dominant. The recording of every transaction makes it harder to steal the funds of the concern, and the finding of correct totals tells how much income is available for dividends at the end of the fiscal period. This last problem, more than any other, appears to govern the forms and definitions of the general or financial accountant.

On the other hand, the cost accountant has to furnish information to guide the management in a great variety of questions of policy. He is concerned with efficiency of production, and the management expects him to gauge the efficiency achieved and to locate inefficiency. He is also concerned with discovering the cost proportionately attributable to particular parts of the business in order to guide the management in its price policies and selling campaigns. He gives them information on the basis of which they may exercise their judgment as to what parts of the business are most profitable and what parts are of little or no profit; how low they can afford to fix prices on a particular contract or a particular class of business, or how high they ought to fix them, or how much they can afford to pay for materials to fill particular orders, or to spend in a selling campaign in order to develop some particular class of business.

Information about the costs of business may be obtained not only by accounting but by statistics. The statistician is commonly interested in general questions affecting many businesses. He may try to discover how great the profits of a given business are on the average, and how much they differ from one enterprise to another. It is possible, however, to use statistics in studying a single business, in trying to find out how its costs really vary in response to changes in volume of output or to changes in other characteristics of the business. This sort of study is not highly developed, but it is capable of becoming a valuable aid and supplement to cost accounting.

Finally, the economist has to do with costs. He is concerned chiefly with the effect of costs on prices under natural competitive conditions, or with estimating monopoly profits as an excess over the earnings that competition would normally bring, or with establishing a fair level of prices and earnings in public service industries.

With all these different people dealing with costs for all these different purposes, it is the most natural thing in the world that they should discover a large variety of ideas about costs, some adapted to one purpose and some to another. It would be impossible and useless to try to adopt a fixed terminology in case it would tend to prevent any one of these people from using the particular ideas which he finds convenient and necessary. The chief thing to do is to understand clearly the different ideas and their relations to each other and especially to the particular purposes they serve.

2. ABSOLUTE VERSUS ALTERNATIVE COSTS

Perhaps the most fundamental distinction is that between two general classes of ideas of cost; absolute costs and alternative costs. Cost in an absolute sense records all diminution of assets. Cost in the alternative sense records the unfavorable side of any given decision which may be made, and always involves a comparison between the policy that was chosen and the policy that was rejected. For example, let us suppose that we want to know the absolute cost of operating a given business, including all money paid out for wages and materials and all actual depreciation or deterioration in the plant itself. These are absolute costs involved in the operation of the business and the maintenance of the investment, for the end of the year must find the capital as large as it was at the beginning, or else no dividends can be considered earned. Whether interest is a cost in this sense or not is a disputed point, about which we shall have something to say later. On the other hand, when a business is under way as a going concern, it often has to decide whether or not to make a special price in order to secure a certain order, or whether to undertake a selling campaign in order to enlarge the output, or to make various other decisions involving an increase or a decrease in the volume of business. In such cases the manager needs to know not merely one cost but two: the cost that he will incur if he makes the special price and takes the added business, and also the cost that he will incur if he does not. Or rather, he needs to know everything bearing on the question how much the added business needs to be worth in order to make him richer for having taken it than he would have been if he had not taken it. For this purpose, interest on investment counts, whether one chooses to define it as a cost or not. On the other hand, since it is the difference which is the important thing, any items common to the two policies may be canceled, and it is not necessary to discover just how large they are, or even to settle possible controversies as to whether they are costs at all.

3. DIRECT OBSERVATION VERSUS DIFFERENTIAL ANALYSIS

There are different ways of tracing costs. We may walk through a plant and see what items of work a given man or a given machine are engaged at, and in this simple way we may trace the costs of labor or of a machine to that particular bit of business. This is the kind of tracing that is thought of in connection with the expression "direct cost" or "special cost."

However, this kind of cost tracing is not the basis for price policies in industrial concerns, and it would not be a proper basis for price policies even if every item of cost could be traced in this way. The direct costs of particular bits of business vary very greatly as a result of accident, weather, or unavoidable irregularities and imperfections of the materials worked with, so that two pairs of shoes, or two suits of clothes, of identical pattern, or two carloads of identically similar freight moved over the same stretch of track, may have cost very different amounts. A price policy has to be based on typical conditions. A consumer has to be charged in proportion to the worth of what he gets, not to the accidental variations in what it costs the producer to turn out things of the same value. There would be no real purpose served by separating the costs of every item of output. All the manager needs to know is the separate cost of such classes of output as might be the object of special price policies.

There is, however, another way of tracing costs which is fundamentally different from this. Instead of merely looking at the process and seeing on what work particular assets are being used, we may focus our attention on the effect of a change in output in increasing or diminishing the total expenses. If a person is familiar with the operation of the business he may be able to imagine the effects of such a change with reasonable accuracy, but if he wishes to be scientific he had better observe a number of such changes and record the results and see what effect the changes of output have on cost. It is this kind of tracing of costs that people have in mind when they speak of "constant and variable expenses."

These two ways of tracing costs have something to do with each other, to this extent: if certain workmen spend their entire time on a certain class of work, it is a fair assumption that their wages will vary approximately in proportion to the amount of that kind of work that is done in the plant. This is not necessarily quite true, however, for if hours are short they may work faster and this will cheapen the product if they are working at a time rate, and if they work overtime at overtime pay, the wage bill will go up out of proportion to the output. The direct method of tracing costs breaks down when it comes to excess pay for overtime, even under a system of piece wages.[1]

Of the two ideas, namely, cost visibly traceable to particular business and changes in cost resulting from changes in business, the latter is the more fundamental and important as a theoretical basis for tracing responsibility for costs, although it is also the more complex and the harder to discover and use as a working tool for allocation. It is more important for fairly obvious reasons. If a given bit of business covers all the additional costs resulting from taking it on, then the concern is not poorer for taking that business than they would have been if they had not taken it. If it covers anything more than this they are richer for having taken it than they would have been if they had not.

On the other hand, it may cover "special costs" or "direct costs" and still the concern might be poorer for having taken it, because some of the other costs may have increased on account of this business. For instance, interest on capital investment is not classed as a direct cost, and yet it varies with variations in the business, although not necessarily in proportion. As a result, a cost accounting system which ignores interest is likely to cause some business to be taken at less than it really costs or at least to represent some business as being much more valuable than it really is.[2]

4. FINANCIAL OUTLAYS OF THE COMPANY VERSUS COSTS OF PRODUCING GOODS

Interest on funded debt is classed as a "fixed charge" and it is often wrongly assumed that this means that it is a "constant cost" of production. Others insist that while interest is a financial charge on the company, it is not a cost of producing goods at all. The fact is that while there is a real difference between financial charges and costs of production, there is also an intimate connection between them, since the financial charges are incurred in order to furnish the wherewithal for the outlays of production. Therefore the two move in close sympathy, but not always at just the same time.

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[1] This point will be discussed more fully in the section entitled "Direct and Indirect Costs."

[2] This matter will be gone into more fully in connection with "Fixed Charges" and "Is Interest a Cost?" (sections 7 and 17 below).

Moreover, interest as a financial charge varies, even though interest on bonds does not, but its variations are complex and hard to trace. However, they move in such close sympathy with the variations of capital used in the actual producing of goods, that the most practicable way to trace them is to forget about the financial charges (except for the purpose of finding a fair representative interest rate) and to follow the process of production instead.

The distinction between financial charges and costs of production may seem a confusing one, yet it can be simply illustrated. Suppose a concern borrows $10,000 to put into materials. It buys the materials, holds them in the stockroom for some weeks and then uses them in filling an order. Which act constitutes the expense: the borrowing of the funds, the buying of the materials, or the using of them in the actual manufacture of the product?

On this matter the standard accounting practice indicates the correct principle. The business firm does not calculate the costs of a given month's business on the basis of the amount spent in that month for materials, but rather on the basis of the amount of materials issued from the stockrooms for actual use during that period. In the same way a railroad does not report cost of coal actually purchased in a given month as a cost for the traffic of that month, but rather the cost of coal issued for use in the engines.

When money is borrowed a cost is incurred, but it is not yet determined that it is a cost of producing goods: still less is it known to what goods this outlay will be devoted. The concern may borrow more than it needs for the moment, and lend the excess until the time comes for spending it, so that their interest outlay for production may not really include all the interest on their bonds or notes. When they spend the money for materials it is virtually committed to production (though even then some of the materials may ultimately be sold instead of used) but still no one knows just what goods it will aid in producing. It is not until the materials are issued for use that they can be charged against a definite product. This principle covers all costs chargeable to these goods, including interest if the concern sees fit to charge it, but it may be that in some cases the amount at issue is not worth the cost of tracing it and that some simpler procedure would be better for the business, on grounds of economy rather than of accuracy.

The raising of fixed capital involves a similar principle, except that after the money is spent for machinery, the interest goes on whether the equipment is busy or idle, so that the amount of actual use can be disregarded. Here interest *as a cost of producing goods* is incurred when the money is spent for machinery, rather than when it is borrowed. Therefore it is essentially contrary to good cost accounting practice to treat interest as a constant cost merely because the charges on the bonds are fixed, because this looks at the wrong index of cost: namely, the raising of the funds instead of the expenditure of them.[1]

The thing that should be looked at is the behavior of the total amount invested in the actual process of production, in order to see how much it varies in response to changes in business. This gives the true "variable cost" on account of interest, and the excess of total interest charges above what can be allocated in this way may be treated as a "constant cost" or may even be disregarded *as a cost of producing goods* and treated as a question of finance rather than a question of production. Thus the "constant expense" for interest on capital may be greater or less than the amount of interest on bonded indebtedness.

The item of interest varies in many ways. A railroad may increase its current borrowings, or it may reduce its temporary holdings of interest-bearing securities, or it may draw down its interest-bearing deposits, or it may simply keep on its line more cars belonging to other railroads, meanwhile paying a rental for their use. All of these involve real increases of the net interest charges of the road. If a company borrowed $1,000,000 for additional cars which they expected to need within the next three years, and only spent half of the money during the first year, they would be forced to put the other half out at interest so that it would not be a great loss to them, and meanwhile the traffic would be properly chargeable only with the interest on the amount actually spent. The bonds might cost five per cent and the market might yield four and one-half per cent, in which case the difference is the cost of provision against future needs and of saving the trouble and expense of making two bond issues instead of one. Ordinarily, however, in such a case the road would arrange its bond issue so that it could be put out in instalments, and thus accomplish the same result.

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[1] See discussion of "Fixed Charges," section 7 below.

Since interest outlays vary in so many different ways, two complications arise. There are different rates of interest applicable to different transactions, and the sum of all these interest charges traceable to particular sections or instalments of output would not naturally be exactly equal to the whole interest burden borne by the business. As for the first point, economy and simplicity require selecting some fair representative rate, if interest is to be reckoned at all. Even if all possible variations could be reported, they would be disregarded when it came to fixing prices or deciding what improvements to make, just as the chance variations in direct costs are disregarded. And any details that would be of no use in making decisions are not worth collecting merely in the interest of abstract accuracy. Hence we come back to the position taken above: that where interest needs to be taken into account in studying the cost of producing goods, the complexities of financial arrangements had best be considered only for purposes of fixing a fair representative interest charge, and attention then focused on the productive use made of the funds. For some purposes, interest may fairly be ignored.

5. LONG-RUN VERSUS SHORT-RUN FLUCTUATIONS

In gauging the effect of added business on cost, it makes a great difference whether we are considering a long-run or a short-run policy. The wages and salaries of the indispensable nucleus of the force are sunk costs which practically cannot be avoided, with reference to a short period. But with reference to a long period they would be a variable cost. Evidently time alters the definition of costs. In fact, the way in which costs behave in response to a 20 per cent increase in business is one thing if we have to deal with a 20 per cent increase in the output of a current month or three months, and a very different thing if we are talking about a permanent increase of 20 per cent in the total business, so that our ups and downs, our good years and our bad years, would all be on a scale 20 per cent larger than before.

In the first case we should handle the output with our existing plant. On the other hand, a permanent growth of business will probably call for an extension of the plant, and this may itself produce an economy, but it will necessarily involve an increase in all those items that remained constant before. The long-run economies of large-scale production are like the short-run economies in this one thing: the added cost of the added business is less than the average cost, up to the point where economy ceases. But no one formula can possibly measure all kinds of cost movements. If it is right for short-run purposes it must be wrong for long-run purposes and vice versa.

6. THEORETICAL OMNISCIENCE VERSUS WORKING APPROXIMATIONS

One source of confusion lies in the fact that the economist, being a scientist with accurate observation as his dominant purpose and omniscience as his will-o'-the-wisp, tends to give terms the meaning they would have to an omniscient observer, forgetting that if such beings exist they have no need of his analysis. And the business man, wanting to know how much his costs will increase as the result of a given amount of business, but compelled to use inaccurate rules-of-thumb and rough-and-ready indexes, tends to describe these indexes in terms of what he wants them to tell him, either forgetting their limitations or forgetting that others will not be so familiar with their limitations as he is himself.

He commonly speaks of "variable costs" as if they were exact measures of the added expenses that will have to be incurred if certain extra business is taken on, when as a matter of fact, he may merely be speaking of a list of expenses which his cost accountants consider as varying somewhere near as much as business varies in the average case. Or he may speak of "general expenses," as the expenses that are "due to" the business as a whole and not to any particular part of it, although as a matter of fact, if those expenses vary, as a result of business having varied in amount, they are in part at least "due to" the volume of business, and the increases in general expenses are "due to" the particular extra business that caused the increase. The confusion in this case rises out of using the words "due to" in two different senses—the one implying physical tracing of effort to result, the other implying differential responsibility.

In this connection, a student must not forget that any conception of cost demands recognition if it has an actual effect on prices or policies of production, no matter if it is illogical or positively incorrect. Railroads may apply (and have applied) short-run conceptions of constant and variable costs to traffic policies which had long-run consequences. They assumed that two-thirds of their costs were not chargeable against added traffic, whereas in the long run, the major part of their costs were properly chargeable against it. Thus they have at times almost certainly taken some classes of traffic at less than cost. The "cost of production" that governs prices in such cases is not the true cost but an erroneous conception of cost, and an economist studying this situation should recognize the error as an actual economic force, at the same time that he strives to expose it.

Modern cost accounting is on its guard against selling goods at less than they cost, and calculates costs with this in view. The result is a "cost" which allocates some overhead but not necessarily all. This "cost" cannot be defined in terms of any coherent principle which the omniscient observer would recognize as a description of the facts. The only way to define it is to tell by what process it is arrived at and to estimate its pragmatic effect.[1] Yet so far as it has an effect it is one of the most important types of cost for the student to consider, let alone the man of affairs.

PART II. CLASSES OF COST

After this preliminary survey of forces and points of view, we may next make a list of the chief classifications of cost which have to do with our main problem, and attempt to give them greater definiteness of meaning.

7. OPERATING EXPENSES AND FIXED CHARGES

This is one of the most widely used classifications though it does not cover the entire ground, for such items as interest on floating debt, and (in the case of railroads) hire of freight cars, are neither operating expenses nor fixed charges, but are included with fixed charges under the general head of "deductions from income." In general, operating expenses include all outlays except taxes, rentals, interest, and certain kinds of losses and sinking fund appropriations, all of which are "deductions from income." Taxes and interest on funded debt are the chief "fixed charges." Depreciation and insurance are sometimes called fixed charges, but in the accounting system prescribed for railroads by the Interstate Commerce Commission they are treated as operating expenses, and the present study will follow that usage. The reckoning runs as follows: gross income less operating expenses equals net earnings of operation. Net earnings of operation less deductions (taxes, rentals, interest on actual debts, etc.) equals net corporate income (or deficit).[2] Net corporate income belongs to the corporation to do with as it pleases.[3]

For our purposes, the chief issue is the true nature of fixed charges, because they are often confused with "constant costs." Fixed charges represent a minimum limit on the net earnings of operation below which they cannot go without insolvency. Nevertheless, they frequently do go below this level, with the result that there is a reorganization and the bondholders accept stock in place of part of their bonds, or some other adjustment is made that reduces the fixed charges, and the business goes on. Fixed charges obviously may cover a very large or a very small part of the capital invested. Two companies may have exactly the same investment, but one of them may have two-thirds of its capital covered by fixed obligations and the other may have no fixed obligations at all. For purposes of the financial records, the income account, and the balance sheet, there is an important difference between these two cases; but for purposes of cost accounting there is—or should be—none.

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[1] This topic will be taken up in section 16 below.

[2] Further adjustments are necessary to distinguish the earnings and costs of the primary business of the company from those of outside investments and outside operations in which it may be engaged.

[3] Subject to claims of minority stockholders if dividends are unduly withheld.

Again, let us suppose a mercantile business which has a funded debt covering half its average capital investment. This business handles periods of extra heavy demand by renting additional floor space and borrowing additional funds for goods and working capital, with the result that in order to handle a 10 per cent increase of business the total investment will increase 10 per cent and the company will have to pay that much more in rentals and interest charges. It is obvious that additional business does not pay unless it covers its full quota of interest charges, and the fact that the bonds represent "a fixed charge" means nothing at all for the purpose of calculating the additional cost of added output. It is simply a low-water mark below which the interest charges cannot go, but there is nothing to prevent them going higher whenever and to whatever extent increased business makes necessary.

Indeed they can go lower, even without a reorganization, in case the funds raised by bonds are not invested in permanent and specialized plants. If they are not tied up in this way, they can be taken out of the original business entirely and invested in securities during an off season. Or space in buildings and plant can be rented for some other industrial purpose, as a furniture store might lease surplus space for studios. The furniture company would still have to meet the interest on its bonds, but *not solely from the furniture business.* As an expense of *selling furniture,* the interest on the bonds does not stand for an inexorable charge that cannot be reduced. So far as it can neither be reduced nor shifted upon some other source of earnings, it may be called a "minimum cost," but it is not correct or appropriate to speak of it as a "constant cost."

When one speaks of "constant costs" and says, for example, that two-thirds of a certain class of costs is constant, that implies that a 10 per cent increase of business will increase this class of costs by about 10 per cent of 33⅓ per cent, or 3⅓ per cent. If two-thirds of the costs are constant and the other one-third varies three times as fast as business, the result is the same as if there were no constant cost at all. For illustration, we might suppose that the cost of "direct labor" in a certain plant varies exactly in proportion to output, but that the concern thinks it wise to put the most valuable and reliable men on a more permanent basis than the ordinary wage-earner and so gives monthly or yearly contracts to one-third of the men, making them in effect salaried employees.

What has happened to the expenses? The total amount is still variable, exactly as before, with all ordinary variations in business. Added output costs its full pro rata share of the direct expenses. If someone who did not know the facts were told that one-third of the cost of direct labor was constant and two-thirds variable, he would be quite misled, for he would naturally assume, for instance, that a 10 per cent increase in business would add only 6⅔ per cent to the cost of direct labor, whereas in fact it would add 10 per cent. What has happened has no effect unless business shrinks to less than one-third its original volume, and then the expenses strike a minimum, though it may still be possible to reduce the expense of *producing the particular goods in question* by shifting part of this labor into some other kind of work.

From this argument it is clear that minimum cost and constant cost both represent important facts but that they are quite distinct from each other. It is also clear that the minimum may be set by contracts the company has entered into and may have nothing strictly to do with the technical facts which determine the smallest cost at which a given kind of industrial process can be carried on. Interest on funded debt represents this kind of a minimum.

8. DIFFERENTIAL AND RESIDUAL COST

When a decision has to be made involving an increase or decrease of *n* units of output, the difference in cost between the two policies may be considered to be the cost really incurred on account of these *n* units of business, or of any similar *n* units. This may be called the differential cost of a given amount of business. It represents the cost that must be incurred if that business is taken and which need not be incurred if that business is not taken. In figuring cost for this purpose, we must include any interest charge which is actually incurred in the one case and could be avoided in the other case.[1] It is clear that cost in this sense depends just as much on one of the proposed alternative policies as it does on the other. The cost of continuing in business and turning out 100,000 units may be one thing if the alternative is to go out of business entirely, or it may be another thing if the alternative is to keep a nucleus of the force on the pay-rolls even if the plant is not running at all.[2]

To the general or financial accountant, such a conception of cost can hardly fail to appear forced, elusive, and unreal. It is not a tool adapted to his uses. But for the problems of economics or of cost-accounting in the broadest sense it represents one of the fundamental facts. One of the best expressions of the underlying idea was made at a conference on cost accounting in these words: "Whenever you exchange commodities or services and as a result have more assets than you *would have*

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[1] Even if one absolutely refuses to count interest as a cost for any purpose, one must calculate added investment and judge if the probable earnings are enough to justify it: that is, judge if the probable gain *outweighs the certain burden of interest on the added capital.*

[2] This point will be developed later in a concrete case (see chapter viii below). This general idea of cost belongs in the same family with the concept of "opportunity cost" of which H. J. Davenport has made a great deal (*Economics of Enterprise*, pp. 61–65, 190–91). He also notes that the purposes of the general accountant require him to use a different concept ("Farm Products and Cost Accounting," *Journal of Political Economy*, XXVII, 354–61).

had if the exchange had not been made you have realized a profit. This is not a problem in accounting but in business."[1]

Some expenses may vary according to one dimension of the business and others according to a different dimension; for example, the terminal and haulage costs of a railroad, or the number of consumers and the number of cubic feet consumed in the case of a gas company. The differential cost of moving more trains per day is one thing and the cost of added tons per train is another, though wise management would maintain a balance between them as methods of moving additional freight, pushing each to the point beyond which the other would be cheaper. In the packing-house the differential cost of putting more steers through the plant is one thing and the separate differential costs of meat, hides, glue, fertilizer, and the other by-products are another thing, and the sum of these separate differentials would not equal the first sum.

All costs not assignable by the differential method may be called "residual costs." Since differential cost includes interest on investment, without regard to whether it is or is not covered by bonds or notes and depending simply on whether a change in the business gives rise to an added need for capital, residual cost would naturally include interest on the entire investment so far as it has not been assigned differentially to some part of the product.

One interesting case, already referred to, is the cost incurred in order to keep a nucleus of the working force together through a period of depression. This is in a very real sense incurred on account of all the business that may be taken on after the depression is over, but hardly on account of any special amount of business taken at any particular time. In this connection when one estimates the cost of maintaining existing output, as compared to reducing it, one must not only deduct all costs that would continue if output were reduced, but also in some cases certain costs that arise out of the reduction itself. Labor turnover is a recognized cost, and is increased by irregularity of output. If it is a case in which the falling-off in demand is clearly temporary, then anything which serves to keep any part of the force occupied instead of turning them off will reduce by that much the cost of building the force up again when business revives.[1] Thus business which serves to fill up the hollow of a depression may be credited with a saving in some expenses that have not yet been incurred. This is clearly "not a problem in accounting, but in business," for accounting can hardly be expected to rely upon quite such an uncertain bit of prophecy for such a radical act as making a deliberate deduction from current operating expenses. However, it seems clear that as a problem in business, goods may be worth producing which are not worth their "cost" as the accounts show it.

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[1] C. B. Williams, in *Year Book of National Association of Cost Accountants*, 1921, p. 201. The italics are my own. Mr. Williams' remarks show that this "problem in business," as he conceives it, includes the liability of "spoiling the market" for future sales as one of the disadvantages of cutting prices. In this sense, goods sold at a price too close to their "differential cost" of production might not show a profit.

9. VARIABLE AND CONSTANT COSTS, FIRST MEANING

This pair of terms has one possible interpretation which makes them practically equivalent to differential and residual costs as defined above, but it is gotten at by a different method. Starting with a search for certain accounting items which do not vary at all with variations in business and other items which vary in proportion to business, one soon finds that there are no items that remain permanently unchanged, few that remain unchanged for relatively short periods, and none that always vary exactly in proportion to business. As a result, every item of cost is bound to have a mixed character.

This is expressed by saying, for example, that maintenance of way on railroads is one-third variable and two-thirds constant.[2] This means that it varies *as if* two-thirds of it were entirely independent of the volume of business and the rest varied exactly in proportion. Such an expression has little meaning except within small ranges of fluctuation. Where fluctuations are appreciably large it becomes an arithmetical impossibility, for two-thirds of the expenses cannot remain constant and still remain two-thirds when the rest of the expenses vary. And one-third of the expenses cannot vary and remain one-third if the rest are constant.

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[1] Discussed by Professor Paul H. Douglas, in "Personnel Problems and the Business Cycle," *Administration*, July 22, 1922.

[2] See Ripley, *Railroads, Rates and Regulation*, p. 55. Later (p. 65) he says that while two-thirds of all the expenses are constant "at any given time" (meaning "over short periods?") over "a long period of years" it might happen, as Acworth concludes, that "nearly one-half of the total expenditures was entirely fixed in character."

What is really meant is that costs vary by about one-third as great a percentage as business does. If business increases 6 per cent this class of cost increases 2 per cent and this is a good enough working formula, as long as one does not try to use it in a case in which the ratio of 2 per cent to 6 per cent no longer holds. If with expanding business we reach a point at which a further increase of 6 per cent will increase expenses in the same proportion, then all costs will have become "variable."[1] Perhaps it would be more correct to say that two-thirds of the *expenses incurred under average conditions of operation* are constant. This presupposes a fixed plant handling a traffic which varies within the limits of the plant's capacity to handle it. The long-run growth of the traffic will require a larger plant, so that "constant costs" in the way of interest and maintenance will become variable in the long run. The larger plant may result in lower operating expenses, so that the costs which are "constant" over short periods may vary more in the long run than those which, over short periods, are "variable." After the plant is enlarged, interest and maintenance at their new level may be just as unresponsive as before to *subsequent short-time changes in volume of traffic*. The expression "constant and variable costs" is used most appropriately with reference to short-run fluctuations of moderate amount.[2]

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[1] Evidently Dr. M. O. Lorenz is using terms in this sense when he speaks as if constant costs tended in the long run to disappear or to become variable. See his "Constant and Variable Expenses and the Distance Tariff," *Quarterly Journal of Economics*, XXI, 283 ff., esp. pp. 284 and 290.

[2] In *Our Economic Organization*, by L. C. Marshall and L. S. Lyon, the term is used in a general way so as to cover both the long-run economies of large-scale production and the short-run economies resulting from using the plant at full

10. VARIABLE AND CONSTANT COSTS, SECOND MEANING

Variable cost may be taken to mean a list of accounting items supposed to vary approximately in proportion to variations in business. Anyone familiar with business will recognize on a moment's consideration that if he made out a list of variable costs with reference to minor fluctuations of business lasting a week or a month, he would have to revise it radically to express what would happen in case of a long-run growth in business lasting over a considerable term of years. Such a list of expenses can never be more than a rough approximation to the true differential cost of added business. Such lists are commonly made out consciously or unconsciously with reference to small and short-run fluctuations, and they make it awkward to speak about long-run changes, because one is forced to say that the "constant costs" have varied, while still calling them "constant costs."

Constant costs would then include a list of accounting items supposed to remain very largely independent of business. Obviously, if one item varies 45 per cent as much as business does and another varies 55 per cent as much as business does, these items might be difficult to classify. A conservative way of drawing the line is to count as constant costs only those items which are substantially unchanged by changes in business. If "constant cost" is estimated in this fashion, "variable cost" will be a great deal larger than the true differential cost of added business. Furthermore, in the long run no costs show this kind of constancy. Constant cost in this sense applies strictly to short-run fluctuations within the limits of the capacity of the existing plant.

11. OTHER MEANINGS OF CONSTANT AND VARIABLE COSTS

Some writers define constant costs as those costs which would go on even if the business stopped running. For some purposes this represents an important fact, but it does not have very much

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capacity, but the illustrations shown in the chapter on constant and variable costs are definitely short-run illustrations, and the explanation of the (long-run) economies of large-scale production includes this as only one out of many causes at work.

to do with the residual cost (or constant cost) which would appear if one calculated the added expense of taking on 10 per cent additional business when the plant is running at its average rate. What we really have to deal with here is a minimum cost rather than a constant cost, although "shutdown cost" would be even more descriptive. This minimum is itself somewhat indefinite, because the question how much expense it is worth while to incur in tiding over a shutdown depends entirely on how long the winter of discontent is likely to be and how warm a summer may be expected afterward. If the manager is confident of a quick and complete resumption, he may keep his foremen and his best laborers on the pay-roll, while if there are no very definite prospects of improvement he will merely try to keep the plant from serious deterioration with as little expense as possible.

So far we have been speaking of variable and constant costs as costs that are or are not affected by the volume of business. However, costs vary from other causes, so that one meaning of constant costs would be costs that are not subject to variation from any cause. Variable cost would include costs varying with accidental conditions, and any costs over whose amount the management has control.[1] In the present study, there will be little or no occasion for making use of these particular meanings, especially as insurance is a most effective device for eliminating the purely accidental variations of cost and turning the cost of accidents into a constant charge on the producer.

12. "SUNK" COSTS[2]

This term suggests the fact that some costs may be elastic upward but not downward. Having once grown, they are not free to shrink again. This has nothing to do with the question whether they vary, in the direction in which they are free to vary, by a smaller or larger percentage than business varies. These "sunk costs" are primarily the costs on account of the permanent and specialized plant, and they mean that increases of cost due to increases of output beyond the capacity of existing plant, and decreases of cost due to decrease of output to less than the capacity of the plant, are governed by different laws. They also mean that even in the very long run there are some costs that cannot be escaped by going out of business. These might be called "abandonment costs" to distinguish them from "shut-down costs" where the shutdown is temporary. For some purposes, the cost of materials already bought or contracted for is a "sunk cost," to the extent that it exceeds what the materials are now worth if sold or held for future use.

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[1] These meanings have been suggested to the writer by some unpublished material on accounting by Mr. Paul Atkins, of the staff of the School of Commerce and Administration, University of Chicago.

[2] This term is used by Harry G. Brown, *Transportation Rates and Their Regulation*, pp. 11–12.

13. URGENT AND POSTPONABLE COSTS

The cost of materials must be incurred before the materials can be manufactured into finished products; likewise the labor that works them up must be paid, but the maintenance of the buildings and machinery may be done when the management pleases, within limits. However, in one sense such costs cannot be postponed. The physical deterioration of a plant goes on whether it is made good or not; and obsolescence reduces its value whether it is provided for or not. It is not the cost, but the making of it good, that is really postponable. The fundamental purpose of a well-managed depreciation account is to take the postponing of such costs out of the discretion of the management by recording a regular accrual of depreciation whether the actual replacements in a given month or year are heavy or light. Thus a good depreciation account minimizes the postponable expenses. In spite of all such devices, however, there is always some possibility of postponing outlays which are needed to keep the plant in good condition and thus virtually understating the expenses of a given year, and overstating the condition of the property. Or the opposite may occur and income may thus be concealed by putting it into betterments and calling them operating expenses.

Even if the cost in the books is stabilized, it still makes a difference whether the actual spending of the money and doing of the work is fairly regular or is concentrated at certain times.

To be sure, stabilizing the account in the books removes the strongest motive for irregularity in the actual doing of the work, and this is one of the greatest benefits derived from a depreciation account. However, there is still no adequate positive motive for *keeping this work regular;* no motive, that is, corresponding in force to the interest the community has in regularization. The individual manager regards postponable expenses as life-savers, enabling him to retrench in hard times; but the life-saving is largely imaginary, for it is done at the expense of reducing employment and general buying power and so reacts by increasing the force of the depression, and ultimately becomes a boomerang.

14. DIRECT AND INDIRECT EXPENSES AND KINDRED CONCEPTS

Direct costs, as we have seen, are costs visibly traceable to a given job or order or class of business without the need of difficult studies or allocations, but merely by watching the process.[1] Certain materials go into certain finished products and certain workmen (and certain machines) spend certain definite amounts of time in working them up. On the other hand, the work of the central office, the power plant, watchmen and sweepers, and the sales force, is not so directly traceable. These costs are indirect, though they may vary with changes in business.

Direct costs are supposed to vary in proportion to the business, but while it is not far from the mark to assume in most cases that they do, still there are notable discrepancies. As we have seen, excess pay for overtime, or a decrease in output per labor hour on account of undue pressure and fatigue, may cause direct costs to vary more than in proportion to business.[2] This is a situation which would not be easily handled by the formula which says that such and such a percentage of costs is variable and such and such a percentage is constant. The idea of differential costs, however, furnishes a relatively simple way to handle it.

If every job were charged with the cost of the particular labor directly spent on it, there would be an absurdity in the case of overtime unless the particular extra order that occasioned the overtime work were always worked at in the overtime hours and at no other time. Otherwise the work immediately responsible for overtime pay would be charged at ordinary rates and other work not actively responsible would be charged with all the excess cost. This might be avoided by distributing the excess pay evenly over all the output, but this would fail to show the full differential cost of the work. The fact is that when a department is working overtime any work done by that department is equally chargeable with the full overtime rates, because that is what the company would save if any of the work were dropped. Here differential cost is greater than average cost (at least in this department), and differential cost multiplied by number of units of output is greater than total cost. So far as direct costs are concerned, the business has reached a stage of "diminishing return." Such a situation cannot be handled by the accredited methods of accounting, which cannot allocate more costs than the total that has been incurred, even where the excess is more than balanced by other indirect costs which are not allocated at all. Yet when a plant has operated eight hours at standard rates and one hour overtime, there should be someone on the premises who could allocate nine hours of overtime pay without endangering his sanity, since with differential costs the whole need not equal the sum of its parts, and differential costs are important things to know about.

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[1] See section 3 above.

[2] *Ibid.*

There are various characteristics which may cause a given kind of work to be classed as an indirect cost. Four may be mentioned. In the first place, work may render a simultaneous service to different kinds of output or to the "business as a whole," and it may be impossible to divide this service into parts except arbitrarily. Secondly, the work may serve one unit of business, but this one may benefit others. Thus different brands of goods advertise each other, or a legal decision sets a precedent that enables thousands of similar transactions to be made without further danger of lawsuits.

Thirdly, the time spent on one thing may have little to do with the value of that thing. This may be merely the result of irregularities and accidents, but it often involves some uncertainty whether the result will be gained at all (as in salesmanship or a lawsuit). Thus it is often doubtful whether the work so far put in has any value at all. It is, in a sense, a "sunk cost." No matter how much effort has already been sunk, it still pays to put in more, up to the full value of the commission to be earned, the disputed property to be secured, or other end to be gained. Thus one may "send good money after bad" and end by spending far more than the whole result is worth.

Fourthly and lastly, it may simply involve too much time and trouble to separate the time spent on different bits of work, so that it is not worth while doing. This is true where a worker turns from one thing to another many times a day, especially if they are different kinds of work. A shop foreman's time would not be worth trying to allocate even if it could be done. These are some of the reasons why some costs are not directly allocated.

Besides the expressions already discussed one often reads of "prime and supplementary costs" and "special and general expenses." These are both ideas of similar character. Special costs are incurred for particular parts of the business and general costs for the business as a whole. In practical usage, the operating expenses of the central office come to be commonly spoken of as "general expenses," although obviously there are many other costs which are not specially attributable to particular items of business.

15. JOINT COST

In the broad sense joint cost has been frequently spoken of as any cost incurred for the benefit of the entire business or of a considerable class of business as a whole, and not for its separate parts. Used loosely, the term may be virtually equivalent to untraced cost, or constant cost, or indirect cost.[1] In its origin, however, the term had to do with a special problem, namely, that of by-products, and it is more useful if it is confined to this original meaning.[1] The savings of by-products are not the same as the general economies of producing one commodity on a large scale or the economies of utilizing a plant to its full capacity. They constitute a third distinct source of economy, arising where different joint products result from a single process and the economy depends on turning them out in *proper proportions* – selling all the hides resulting from a given number of cattle slaughtered, and also all the meat, all the suet, and the other by-products. On a railroad eastbound and westbound traffic are joint, because it is cheaper to produce them together than separately, regardless of the total volume of tonnage moved. But passengers and freight are not joint in the same sense, because it would be cheaper to carry them separately, letting one road carry nothing but passengers and others nothing but freight, if roads could get adequate traffic in this way. Railroads carry freight and passengers both, simply because any increase in traffic is a gain, and it pays them to do so in spite of the diversity between different classes of traffic, and not because of it.[2]

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[1] The author has used the term thus broadly in his *Standards of Reasonableness in Local Freight Discriminations*, "Columbia University Studies," Vol. 37, No. 1, p. 24, but now prefers the stricter usage. This subject will be taken up more fully in chapter v below.

16. MANUFACTURING VERSUS SELLING EXPENSE

It is a commonplace that the economies of increased output are largely responsible for the modern emphasis on selling, especially for the attempt to capture nation-wide and world wide markets. *After a plant is once installed, the cost of operation depends on the success of the selling force in marketing* enough goods to utilize the equipment adequately. Thus overhead costs in production stimulate the producer to increase the overhead costs of selling. Beyond this introductory commonplace, there is room for a great deal of useful study in describing the true relations of these two departments of a business, and of the corresponding costs. If economics has paid insufficient attention to overhead costs of production, it has definitely ignored the costs and services of selling goods, in formulating the formal laws of value.[1]

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[1] See especially John Stuart Mill, *Principles of Political Economy*, Book III, chap. xvi, section 1. Professor Taussig applied the term to railroad traffic in general ("A Contribution to the Theory of Railroad Rates," *Quarterly Journal of Economics*, V, 443–45). He adopts a middle ground, making the term cover any case where overhead costs are large, so that added traffic brings economies, *and where output is heterogeneous*. But this usage precipitated lengthy controversies with Professors Seligman and Pigou (see *Quarterly Journal of Economics*, XX, 630–31; XXI, 151, 155–82, 162–64; XXVII, 378–84, 535–38, 687–94). These disputes are inherently incapable of logical settlement, largely because the question, "When is output homogeneous and when is it heterogeneous?" when asked in abstract terms, can never be finally answered. One answer is: Output is heterogeneous whenever any differences exist which can be used as a basis for discrimination. But since discriminations may be based on the color of the customer's skin, or the style of his garments, this would cover all cases of overhead cost, and rob the term "joint cost" of all special meaning. The only other point where a clear line can be drawn is the point at which heterogeneity of output becomes in itself *a cause of economies*. (See Edgeworth, "Contributions to the Theory of Railway Rates," *Economic Journal*, XXI, 558, and Dewsnup, "Railway Rate Theory and Practice," *Political Science Quarterly*, XXX, 476–509.)

[2] This point is more fully discussed in chap. v below.

Some goods are not produced until they have been sold (e.g., "made-to-order" clothing, locomotives and other special machinery, and most construction work), others are not sold until after they are made, being "made to stock" in the first instance. Even in such cases, however, a concern likes to get orders ahead. Where goods are made only to order, production depends on sales in a more immediate and imperative way than when they can be made to stock; thus there is pressure to sell, but no compulsion to sell below cost. On the other hand, when unsold goods are piling up, there comes a point when continued production depends upon moving the existing stock off the shelves. With this pressure to sell goes the further fact that the cost of production is now a "sunk cost," and may not be recoverable at all. Hence it no longer sets a minimum limit on price. Thus direct costs of manufacture may, on occasions, be treated as overhead, where selling comes after production.

These special cases, however, do not affect the two underlying facts: first, that selling costs must be added to costs of manufacture and prices must cover them both in the long run; and, second, that the cost of selling combines several of the essential characteristics of an "overhead cost," so that accountants commonly treat it as "burden," and allot a given rate, or percentage, to cover it. In the first place, the selling effort is quite like a battle, and its economics are of the same variety as the economics of a barrage fire. It only takes one bullet to kill one man, if it hits him, but "it takes a ton of lead," counting the bullets that miss. And the bullets that miss are just as necessary as those that hit, because no one can tell, when the ammunition is served out, which will find a mark.

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[1] Cf. G. B. Dibblee, *The Laws of Supply and Demand*, pp. 50–74. Mr. Dibblee emphasizes selling as an overhead outlay.

In selling, the bullets that hit must pay for those that miss, and in many kinds of selling effort the hits are a small percentage, so that most of the expense must be allotted. Advertisers do their best to trace the shots that hit, not for purposes of crediting the sale to a particular letter or interview, but chiefly to judge the relative productiveness of different advertising media, or of different types of appeal. In personal selling or in individual advertising via the mails, there is a chance to distinguish between customers as to whether they are good or bad "prospects" for future efforts, but here again a man who has responded once seems to remain indefinitely on the lists of prospects, and sometimes the effort spent upon him is inversely proportional to the subsequent response. The "marginal" or doubtful buyer, like the independent voter, is the critical field for selling effort. In any case, such tracing of appeal and response in advertising is not used or useful in determining the direct cost of single sales.

In the second place, when the selling effort is made, the prospective buyer is commonly offered a choice between different types of goods, and until he exercises his option and sends in his order, the producer cannot tell what particular product he was engaged in selling, and, therefore, cannot charge the cost of the preliminary steps against a specific piece of work in the factory, or a particular brand of goods on the shelves. This is not true when goods are sold before they are made, but in such cases there are other sufficient reasons for treating selling cost as overhead.

In the third place, since selling to doubtful buyers is often a matter of "summation of stimuli," a given amount of effort may bring no result at all unless more is sent after it. If there is any clear estimate of the amount of effort which is worth expending to make a given sale, then as soon as that much has been spent it becomes a "sunk cost," and it then is worth while to spend as much more, if necessary, in order to bring the sale to pass. Thus the aggregate effort often mounts up to far more than the sale would justify.

In the fourth place, selling effort is often regarded as a long-time investment in "good-will." Sales made today do not stand alone; if they mean satisfied customers they mean future sales. If this good-will were a tangible asset it would be carried on the books at cost, and depreciation would be charged on it, based on its probable term of life. As it is, one cannot tell with certainty what is the cost properly chargeable to capital in such a case. It costs something to maintain good-will, but how much is a matter of guesswork; hence it is uncertain how much of a given year's expenses is a current charge and how much has really gone into increasing the company's intangible assets. And the obsolescence of good-will is more insidious and far more uncertain than even the obsolescence of a machine. Thus it is unsafe to record good-will as a capital asset, at least until it has had a considerable time in which to demonstrate its value. Hence expenses for building it up must, for the most part, be charged as current costs, not as capital outlays, and hence the accounts carry elements of cost which need not, as a matter of business policy, be justified by the business of the particular year in which they were incurred.

In the fifth place, goods help to sell each other, so that advertising is not wholly separate from the selling of goods. A sale may itself be a bit of advertising. Free samples are an obvious example, while "leaders" furnish a distinct economic problem. Is it fair to sell goods at less than cost, or at unduly low margins, in order to push other sales? A "leader" is generally a commodity that is standardized and well known: either something homogeneous like sugar or a branded article which has a customary price, so that the customer is sure to be aware of any bargain that may be offered him. To make this kind of advertising profitable the same concern must sell other goods, which are less standardized or not so well known, where the loss on the "leaders" can be made up without attracting the customer's notice. This means that retail trading is the chief indicated field for this kind of selling tactics, for here one concern sells a considerable variety of products, and the customers are better acquainted with some than with others.

Sixth, selling costs, and the results gained, are immensely variable, so that the worth of a given effort has very little to do with its cost. This has already been recognized as a characteristic of indirect expenses.

One type of advertising which is clearly general in character consists of cultivating a favorable public opinion toward the company, without direct reference to the price or quality of particular goods. Concerns attempt to educate the public as to their methods of production and welfare work, the size and character of their organization, and its history and traditions, and they sometimes lend their advertising space to publicity for some matter of purely public interest. The concern may hope to benefit via the market or via the legislature: It may avoid the danger of harmful legislation, or it may sell more goods to persons who prefer to deal with a concern of good public character; one which has an *esprit de corps;* one which does more than the letter of its bond requires, and bears its share of community burdens. If this kind of publicity is properly a cost at all, it is clearly indirect.

One type of selling expense is direct and variable; namely, commissions paid to agents or salespeople on the basis of volume of sales. Sometimes this is varied by granting a special premium for disposing of "stickers" goods which have remained unsold longer than they should. This may be a more effective way of pushing these goods off the shelves than to give the same premium to the customer in the shape of a lowered price, though, if so, the fact is a sad testimonial to the consumer's judgment of qualities. At best, however, the result must be to divert selling effort from better and newer goods, which would yield better results in the long run. It is an attempt to protect the normal margin above the original cost of the goods, when that cost has become a matter of ancient history. The low-priced basement departments, which many large stores now operate, furnish a more logical avenue for the disposal of such goods.

17. COST IN THE SENSE USED BY COST ACCOUNTANCY

Since cost accounting systems differ in what they include, it is difficult to frame a definition that will cover all cases. Cost in this sense always includes direct cost plus a percentage of indirect cost which is allocated in some uniform fashion. The system may undertake to allocate everything, including interest on the entire investment, or it may stop at operating expenses. Apparently, progress is in the direction of allocating everything, including interest on the investment.

Cost as conceived by this type of cost accounting appears to represent an amount such that if the company can charge that much and get it, on what is considered to be a "standard" rate of output, the business may be regarded as in a satisfactory financial condition. The investment will "pay," and the original decision to embark on the business will have justified itself and recompensed all sacrifices involved. Under ordinary circumstances, this cost is supposed to be treated as a minimum below which prices will not be cut, but this minimum presumably has some elasticity, since it is not always possible to make a given return on the investment and in that case it is not good business to hold to a rigid price policy at which the market will not take the goods. Cost in this sense comes very near the economist's idea of normal price or value, and this implies that actual prices will be below it about as often as above. Where cost accounting confines itself to operating expenses and does not include interest on the investment, the managers must make their own allowance for the necessary profits, and their prices must necessarily run considerably above the level of "cost."

The cost accountant's problem is a difficult one. He has to furnish evidence on questions of policy where differential costs are the important thing and yet differential costs cannot be a part of his original records, for these can only set down what happens, and not engage directly in comparisons with the past or conjectures for the future. He is responsible for reporting present facts in such form as to help the management avoid two opposite errors—that of selling goods at a loss and that of setting a price so high as to prevent some sales when the concern would be richer if it had sold the goods at a lower price.[1]

In furthering the first purpose, cost accountants have evolved the system of allocating "burden." "Burden" includes indirect operating expenses and also interest, when interest is treated as a cost; and every item of output has a share of burden allotted to it on some basis that seems reasonable and appropriate. But this process might go too far, and violate the second purpose of cost accounting by charging goods with a share of costs that are constant, and losing sales that would more than cover the variable or differential costs involved. Goods might seem to cost more in time of depression merely because constant costs are divided among fewer units of output, although to raise prices at such a time in order to cover the constant costs would be a manifest absurdity, and would defeat its own end. In partial recognition of these facts, cost accountants commonly charge each unit of goods, not with the actual burden divided by the actual output, but with a "standard rate," covering what the burden ought to be at normal or "standard" output. Thus in time of depression not all the burden is distributed; some is left "unabsorbed."

Cost as reported in the cost accounts becomes, then, direct cost plus the goods' share of the standard burden. It is not the same thing as cost in the sense used by the general accountant or by the economist. It is not a pure record of fact but contains arbitrary quantities and elements of judgment or conjecture. It is not total cost nor differential cost nor variable cost nor direct cost. It is a species by itself, and its justification must be wholly in terms of the purposes it serves.

PART III. CONCLUDING QUESTIONS

18. IS INTEREST A PART OF COST?

It is perfectly clear that from the point of view of that kind of cost accounting which seeks to discover a satisfactory price, interest on the entire investment is included. This is equally true from the point of view of an economist seeking for the laws of natural price. On the other hand, the Federal Trade Commission does not include interest as a cost.[1] Their chief purpose is to discover what the actual earnings have been with a view to deciding whether they furnish evidence of monopolistic extortion. For this purpose interest on debts means little, while figures of total investment are none too reliable. Moreover, even if these figures were accurate, the Commission is hardly in a position to determine a fair rate of interest for many different industries, with the inevitable implication that all earnings above this rate are excess profits. This might seem premature, in view of the fact that the courts have the last word. But if they publish earnings as a percentage on investment, then argument can be joined as to whether this is more than a fair return under all the conditions prevailing in each particular case. And so far as correction might be needed for errors in the figures for investment, such correction would be put in a simpler form.

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[1] Another duty is that of furnishing a conservative inventory value of goods in process.

As for differential costs, it is perfectly clear that any comparison of cost between two different rates of output or two different production policies may involve a difference in investment, and the interest on this difference is an essential item in the comparison. It is impossible to estimate the cost of producing goods by labor-saving machines as compared with the cost of producing them by hand unless the interest on the machinery is taken into account. In calculating differential costs, interest may be the same on both sides of the reckoning and so cancel out, or there may be a balance on one side or the other, which becomes a part of differential cost. Differential cost may include more than operating expenses, or less.

On the other hand, from the point of view of financial accounting, governed as it is by the legal liabilities of the business, it is clear that interest on bonds and notes is a cost in a certain sense, but interest on the investment represented by stock is not a cost, from that standpoint. The economist has no need to quarrel with the accountant's usage in the matter of the income account, provided that usage is not extended beyond its proper field and imposed upon cost accounting and cost analysis in such a way as to distort their data and warp their findings.

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[1] Cf. statement of Dr. Francis Walker, *Yearbook of National Association of Cost Accountants*, 1921, pp. 75 ff. His chief arguments are: (1) Accountants are opposed to it. (2) Uniformity is desirable. (3) For the commission's purpose in detecting extortionate gains, interest is a "profit."

Among enlightened accountants the question whether interest is a cost appears to be reducing itself to a question whether it shall be so set down in the books from which the formal income account and balance sheet are made up, or whether it shall be separately taken account of in particular calculations wherever needed in analyzing the facts of cost for any particular purpose.[1] That is, it is admittedly an element in *cost analysis*, though not necessarily in the general books of account. If it is not reckoned in the books, it must be added for certain purposes, and if it is reckoned in the books it must be subtracted again for certain other purposes, so that in intelligent hands the question becomes largely one of convenience.

19. COST FROM THE STANDPOINT OF DIFFERENT PURPOSES

We have seen that the cost-accounting conceptions of cost do not agree with cost as used by the general accountant, and that they disagree because they are wanted for different purposes. The different ideas can be combined in the same statement if the cost accounts do not include interest, by first reckoning the direct cost and the burden allocated to particular items of ouput and then adding the "unabsorbed burden." The result would be the total operating expense. If the cost accounts include interest on the entire investment as part of the burden, the harmonizing of cost accounts and general accounts would not be so simple, because the general accounts cannot very well include interest on the stockholders' investment as a cost. Of course, there is no absolute need to harmonize them, even though they must both be built up from the same basic records. There are, in fact, minor discrepancies permitted, even where interest is not treated as a cost.

This is really necessary, even from the standpoint of cost accounting alone, for it has conflicting purposes to serve within its own technique. Costs are used to set a value on goods in process or awaiting sale and this value must be conservative. In this matter the banks set standards to which business is obliged to conform if it wants to get credit, requiring that inventories shall exclude interest or report it separately. Another consideration is the feeling that prices should normally be above cost, and that prices below cost are an absurdity. So that where good business judgment dictates certain prices and these turn out to be below the nominal "cost," that seems to show that the cost accounts have something very queer about them. Since sound business judgment may at times dictate selling goods at barely more than their differential cost, cost accounts would be revolutionized if this principle were taken at its face value. Both these considerations are in hopeless conflict with the idea of cost as an amount that would be a satisfactory average price to charge.

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[1] *Year Book of National Association of Cost Accountants*, 1921, pp. 45–96, esp. pp. 90, 92–3.

This being the case, the thing to do is to cease trying to make one concept do the work of several. After all, the obligations a corporation must meet before dividends are paid are one thing, and the whole financial outgo or sacrifice attributable to the act of producing certain goods is another thing, and a conservative standard for valuing unsold goods is still a different thing. Undoubtedly the ultimate solution lies in the development of systems of cost analysis which shall be separate from the formal books of account, though based on the same data. This analysis will be free to study differential cost and cost as a normal supply-price, without being tied down by the rules that are legitimate and necessary in financial accounting.

The economist also uses both these conceptions because they represent forces governing price. One is a long-run standard, the other a natural minimum limit on short-run fluctuations. Abandonment costs play an important part in determining who the typical marginal producer is, and shutdown costs furnish an incentive to maintain production in off times, and a measure of the waste of unemployed capital, so far as it is borne by the business enterprise.

The statistician, as such, has no characteristic purposes, but he has a technique peculiarly adapted to the study of differential costs. The engineer has to deal with the total cost (in the economist's sense) involved in new enterprises, and with comparisons of total cost for different kinds of plant, or for different policies in a going concern where some change of the plant is involved. He must therefore take account of interest on investment. Thus he deals with total cost and with differential cost, but the canons of general accounting are foreign to his needs.

20. CONCLUSION

If this overlong discussion has justified itself, it should have shown why there cannot be found one universal meaning for "cost of production," and it should have helped the reader, when he encounters the many current usages, to translate them if necessary into consistent language and to recognize whether any given conception of cost is being used for its proper purpose or is being abused. We next turn to the different laws governing the variation of cost and especially the different "independent variables" whose changes bring about changes in costs of production.

CHAPTER IV

THE LAWS OF RETURN AND ECONOMY, OR THE VARIABLES GOVERNING EFFICIENCY

SUMMARY

Introduction, 69—The elastic limits of productive activity, 72—Reciprocal relation of the factors, 73—Unlimited capacities of labor and unspecialized capital, 76—*Twelve variables governing efficiency*, 79—*Importance of distinguishing these variables*, 83.

I. INTRODUCTION

One of the most important aspects of overhead costs is the fact that increased output commonly brings increased efficiency or decreased expense per unit. Here we are dealing with what economists used to call the "law of increasing return," the law which was once supposed to be characteristic of manufactures in contrast with agriculture. In this study we shall not use this terminology, because it suggests an antithesis with the "law of diminishing return," where none exists. The two laws are not measured on the same yardstick; diminishing return commonly refers to such units as bushels of wheat per laborer, or horsepower per pound of coal burned; while increasing return typically applies to bushels of wheat per dollar expended, on *labor, land, and all other means of production* (cost per bushel), or ton-miles of freight moved per dollar expended on coal, engines, rails, terminals, labor of all sorts, and all other sources of expenditure (cost per ton-mile). Therefore, when the terms "increasing or diminishing return" are used in this study, they will refer primarily to physical results achieved per unit of some technical factor of production, or of some group of factors representing only a *part* of the total expenses of production.[1] Thus it will never be a measure of the economic efficiency or financial economy of the whole process. Where we are dealing with the return per dollar expended for all purposes, we shall speak of efficiency or economy or cost, not of "return."[1]

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[1] This distinction is made by F. M. Taylor, *Principles of Economics*, 2d ed., pp. 137, 149-50.

Since "diminishing return" refers only to a part of the factors of production and therefore covers only a part of the total cost, it is easy to see why it may go hand in hand with increasing economy in the whole expenditure, if the other elements in cost remain constant while output increases.[2] Decreased yield per laborer does not condemn intensive farming if it brings increased yield per acre, for where land is expensive, the net result may be an economy. In quite the same way, overtime work in a factory may bring decreased yield per hour of direct labor or per dollar spent on direct labor, but total cost per unit may be reduced because the permanent plant and the "indirect labor" involve large elements of constant expense. Direct costs per unit may increase while indirect costs per unit are diminishing.

For this and other reasons, it has long been evident to economists that to speak as if there were two "laws of return," a "law of increasing return," and a "law of diminishing return" is inadequate, inappropriate, and confusing. A law should describe the way something acts, and where there are a number of different things that act differently, the way to distinguish one law from another is by the different things that do the acting. The fact is that there are a great many things worth studying as independent variables, each of which affects output in its own particular way and each of which accordingly has its own law—or group of laws, for each plant may be to some extent a law unto itself. Each "law" may go through a stage of increase and a stage of decrease either in technical return or in general economic efficiency, as the case may be. Some of these principles have been confused seriously in the past.

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[1] The author is indebted to a conversation with his colleague, Professor Jacob Viner, of the University of Chicago, for the suggestion that "increasing return" in the sense of general efficiency can best be described as "decreasing cost" in order to indicate the fact that it deals with different dimensions from "decreasing returns" in the usual sense. Mr. Viner is, of course, not to be held responsible for the formulation here given. Not only do the two laws deal with different measures of return but they study the effects of different causes.

[2] See Carver, *Distribution of Wealth*, pp. 87–89. "Diminishing return" as commonly used typically expresses the effect of changing *proportions of the productive factors;* "increasing return" reports the effect of increased total output. This distinction is stressed by Carver (*ibid.*, pp. 65, 76, 90–91), Davenport (*Economics of Enterprise*, chap. xxiii), and others.

2. THE ELASTIC LIMITS OF PRODUCTIVE ACTIVITY

If there is any general principle underlying all these laws, it is that economies result from developing the unused capacities of productive factors, and that the exploitation of the capacities of any factor encounters elastic limits and increasing resistance.[1] In particular, one may lay down the proposition that whenever a productive factor which costs something has any unused capacity which can be developed without encountering unduly increasing resistance, there is an opportunity for financial economy in utilizing that capacity. Resistance becomes "undue" when the differential cost of added output becomes greater than average cost (including a pro rata share of the cost of the constant factor).

So far as free goods are concerned the question of unused capacity simply does not arise, because we never utilize such things up to the point of increasing resistance. Indeed, that is the reason why they are free. Not merely such things as air and water, but the underlying forces of nature may be regarded as free goods. Natural forces have unlimited capacity and, up to the limits set by patents and secret processes, the knowledge of how to utilize them is free: a community asset. However, the equipment to harness these forces has limited capacity, and this includes all the tangible economic factors of production.

This common fact of developing the latent capacities of a factor of production in the face of increasing difficulty appears under many guises. The "law of proportion of factors" refers to getting more results out of one factor (for example, land or a locomotive boiler) with the help of increasing amounts of another factor (for example, farm labor, or coal fired under a boiler), with the result that, in general, the more we get out of the land, or the boiler, the less we get out of each laborer or each pound of coal. In studying this process, two facts of prime importance stand out. The first is that while the capacity of some factors has definitely fixed limits, such as the heat contained in coal, or the products of any chemical reaction, or the tractive power of a given locomotive on the best possible roadbed; other factors seem to have no assignable limits on their capacity, depending only on how much of the complementary factors are lavished upon them.[1] The second fact is that there is a reciprocal relation between the extent to which the capacities of different factors are utilized; that the capacity of one factor can be fully utilized only by having some other factors working at relatively low efficiency.

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[1] Cf. F. M. Taylor, *op. cit.*, pp. 136, 138.

3. RECIPROCAL RELATION OF THE FACTORS

This is a universal law which holds good throughout all forms of production. It was originally seen in the case of land, where the ultimate capacity of the laborer could be attained if he had unlimited quantities of land to farm, resulting in a relatively low crop per acre; while the ultimate capacity of land could be approximated by farming very intensively, with the result of a relatively low crop per laborer. In the same way, if more time and care is spent in economizing materials, a given amount of materials will produce more finished product, and no plant ever uses its materials so very carefully as to utilize absolutely 100 per cent of their possibilities. It would be wasteful to do this. It would not pay to spend ten dollars' worth of labor to save two dollars' worth of materials, although the result would increase the "efficiency" of the materials, if we look at it solely from this point of view: If the materials were to go up in price until what was worth two dollars before came to be worth twenty, then it would pay to spend ten dollars' worth of labor to economize the same amount of material which before it paid to waste.

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[1] The chemical aspect of the law of proportion of factors is best treated by Carver, who shows that if two elements are put together in the exact proportions in which they combine to make a given compound (e.g., oxygen and gasoline in a carbureter), not all of either element will be combined, but there will be an uncombined residue of both. An excess of one will increase the percentage of the other that is taken into combination, though, of course, it means utilizing a smaller percentage of the element that is in excess. Thus chemical combinations obey the law of "diminishing return." The chief point of this illustration is that elasticity exists even where we should least expect it. There is elasticity in the usefulness of factors supplied, even where there is none in the amounts ultimately utilized. See Carver, *Principles of Political Economy*, 1919, p. 367; *Principles of National Economy*, pp. 437-83. He cites the manufacture of ether from alcohol, which is expensive, and acids, which are cheap, where the acids are used in excess of the chemical proportion.

Part of the efficiency of a garment cutter consists in planning his cuts so as to economize his material, but it would not pay him to spend all day in order to save a few inches. That is, it would not pay unless perhaps there were going to be hundreds of identical garments cut, so that a few inches of cloth per garment would be worth more than his day's labor would cost. There is another side to this same illustration, for by giving the cutter more cloth per garment, he can do his cutting with less perfect planning and therefore more rapidly, and can turn out more garments in a day's work. Thus, with more cloth to work with, the inherent capacity of the cutter is more fully developed. Perhaps, by giving him 20 per cent more cloth and letting him work more rapidly and less carefully, he could turn out 16 or 18 per cent more garments in a week.

An interesting case, illustrating this principle, was reported by Mr. E. W. Dudley, in a paper on "Wastes in Air-brake Service."[1] After describing the waste due to leakage in this country, he said:

> They don't know what leakage is in Europe. One of your best known members told me of riding on a French railway locomotive during the war and being almost paralyzed to see the engineer calmly reach over and shut the throttle valve in the air compressor steam pipe shortly after leaving the station. There was about 80 lbs. pressure in the system and there it stayed until the brakes were used to make the next stop, when the pump throttle was opened up and the pressure restored. There were no leaks—they were not tolerated. Why? Because at that time coal was $64 per ton and the engineman received a bonus on every pound he could save. So it can be done.
>
> We avoid the cost of a good tight pipe job, of close inspection and of competent repairing, but burn more coal. We need to do more than make rules about these things. We must have the right kind of men, enough of them, and encourage them by giving them the tools, the materials, and the

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[1] Paper read before the 1922 Convention of the Air Brake Association, reported in *Railway Age*, June 20, 1922, p. 1606.

proper places to do the work. No man can turn out a decent job with only a pipe wrench, a paint brush and a lack of proper material or conveniences.

Here we have a clear statement of the need of spending more of some factors in order to economize others, and of the importance of the cost of each factor in governing methods of production.

Or, we might take a machine as an example. We can develop the latent capacity of the machine by spending labor lavishly to see that it has a continuous supply of materials and that it can always get repairs the instant they are needed and is watched every minute. This would mean that machine tenders would not be taking care of as many machines as they might, and it would mean that the repair force would be quite large and might spend a great deal of its time waiting for something to go wrong. It would mean that the capacity of the machine tenders and the repair men was being imperfectly utilized in order to utilize more fully the capacity of the machines themselves.

On the other hand, the management might try to have every laborer tend as many machines as possible. As a result, the capacity of the laborer would be brought out much more fully, but the machines might not work as well. In spinning, the chief knack of the frame tender is to tie up broken threads quickly. By installing an automatic device that stops the machine when a thread breaks, one man has been enabled to tend more frames. But an automatic stop costs something, so that capital increases faster than output. With such a device, it would be physically possible for one man to tend an unheard-of number of spindles, but machines would spend a considerable percentage of the time idle, waiting for the machine tender to get around to tie up the thread and start the machine again. It is evident that the product per man can be made very high on condition that the output per machine (and even more, the output per one hundred dollars invested in machinery) should be relatively low.

Similarly, if the repair force is to be kept extremely busy and is to make a high record of efficiency, in the sense of repairs accomplished per man, the size of the force will be very small compared to the amount of equipment they have to take care of, and when a machine needs repairs it will have to wait its turn until the repair force finishes other work, so that the percentage of idle time for the machinery and the active operators will be increased. In other words, in order to utilize the capacity of the repair force most efficiently, the rest of the plant would work at something less than the greatest efficiency of which it was capable. Here we have two possible types of inefficiency, one where the repair force is so large that nobody ever has to wait for repairs, while the repair men spend most of their time idly waiting for something to do, and the other where the repair force does not waste any of its time, but keeps the machines and their operatives waiting. Somewhere between these two types of inefficiency there is a balance; a point of maximum economy in terms of the total cost of machinery, repair men, and active operators.

When it comes to retailing, there is a final party whose efficiency is to be considered; namely, the consumer. Each salesman may make more sales where there are so few of them that most of the customers have to wait a long while to be served. This means that the customers' time is used inefficiently: a burden they are likely to resent out of proportion to the value of anything they might have done with the wasted minutes. Here the point of true efficiency is hard to determine, lacking a money measure of the worth of the customers' time.

4. UNLIMITED CAPACITIES OF LABOR AND UNSPECIALIZED CAPITAL

In the days of handicraft industry, tools were not so expensive but that every craftsman could own a fairly full equipment. If a number of craftsmen had gotten together and used one set of tools between them, the capacity of the tools would have been more fully utilized—the output per saw and per hammer would have increased—but the loss of human efficiency would have more than outweighed the gain. With the introduction of the gigantic engines of modern industry, the efficiency of the tool becomes much more important and the output per laborer is no longer the decisive feature of the case. The expensive machine cannot afford to stand idle as large a percentage of the day as a carpenter's saw or hammer or chisel. The proportion of things must be so adjusted that its capacity is much more fully developed.

But another much more significant change results from machinery. Mechanical work is limited by the source of power, and with the advent of this iron slave we have freed the capacities of labor from the limits set by animal power—his own or that of his beasts of burden. As a result, small amounts of either labor or capital will suffice for enormous works if there are unlimited amounts of the other factor to work with because the other factor can, if necessary, furnish the bulk of the power. The pyramids were built with primitive mechanisms and untold labor: the capacities of a little capital were brought out in a way that amazes modern observers, but the efficiency of labor was low, and the cost in labor was lavish. Today the opposite trend prevails, and single laborers control unheard-of masses of power and with it perform miracles, though the product per unit of investment in machinery is diminishing.[1]

Still more significant, perhaps, is the fact that human labor comes to be more and more a matter of overseeing and guiding the iron slave; the laborer has in fact become a supervisor. But work of supervision is commonly spoken of as an "overhead cost." It does not vary definitely with output. No more effort is necessary (though more may be profitably spent) to plan for turning out an order of a thousand window sashes than a hundred, no more brainwork to decide to adopt a patented fire-extinguishing system for a plant with a million square feet of floor-space than for one with ten thousand. For essentially the same reason it costs no more labor to steer the greatest liner than a motor-boat, and not nearly as much as to steer a Gloucester fishing schooner. A man with a shovel could perhaps unload from thirty to thirty-five or forty tons of coal in a day. The same man in charge of an ordinary bucket and crane can unload five or ten tons in forty seconds or less, while at the controls of a car dumper he may be able to "oversee" the dumping of a fifty-ton car every minute of the day, if there are that many cars to be dumped. When labor takes the form of supervising the harnessed forces of nature it may become an "overhead cost" like any other form of supervision, largely independent of variations in the amount of force that lies under its control.

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[1] The figures of the census bear this out to the extent of showing a progressive decrease in value of products per dollar of capital invested as capital per establishment and per laborer increases. There is perhaps no absolutely satisfactory way in which to measure investment in modern machinery and compare it with that of fifty or two hundred years ago, for dollars have changed their purchasing power, and other standards are open to criticism. However, if the equipment of the handicraft era were reproduced and put in service today, a fair comparison would be possible in terms of dollars invested; and there is not a shadow of doubt that the result would verify the above statement.

So far we have been speaking of some of the more general aspects of the development of unused capacities, chiefly in relation to the proportions of different factors used with each other in production. This fact is also clearly at the basis of the idea of constant costs as distinct from costs which vary with output. A railroad track is a stock illustration, and it is commonly assumed that railroad plant in general is a constant asset and that the labor of operating trains varies with traffic. However, the only way to secure full utilization of the track is to run heavier and heavier trains, and this means that rails, ballast, cars, and locomotives all grow heavier and more expensive while the yard tracks and station buildings increase in harmony.

As a result, the nearest thing to a really constant outlay that can easily be found in the long run is the work of the locomotive engineer and fireman. This varies somewhat in one sense. A mechanical stoker may become necessary with larger locomotives, and a differential wage may be established; nevertheless this item of labor cost is more nearly constant, with *changing trainloads*, than any capital item is, in the long run. And since the number of trains that can be efficiently run on a given track is a relatively stable item, increasing trainloads are one of the necessary ways of handling increased traffic, except where it is very sparse. One might say that the latent capacity of the engine-crew is developed by giving them a bigger locomotive to handle and more freight to haul.

5. TWELVE VARIABLES GOVERNING EFFICIENCY

Without attempting to cover all the variables which govern industrial efficiency, there are certain fairly tangible ones whose effects have something to do with overhead costs. Among these twelve are worth mentioning here.

a) The proportion between different productive factors.—The law governing this variable is commonly called the law of diminishing return, though it has stages of increasing and constant returns.

b) The percentage of the full capacity of the plant which is utilized.—This may be called the "capacity factor."[1] It appears either in connection with short-run fluctuations of business or with building in advance of expected growth, because in the long run the size of the plant would adapt itself to any steady rate of output. The economies of full utilization are commonly spoken of as a "law of increasing returns," although the same term is also used to cover the general economies of large-scale production, and there is frequent lack of adequate distinction between these two cases. We shall not speak of it as a "law of return" at all, but as a law of economy or cost.

c) Steadiness or fluctuation in the rate of output.—The chief measure of this is the "load factor," or ratio of average output to maximum output during a given period.[2] This is coming to be a much-used term with its related ideas of "peak load" or "maximum demand," and of "off-peak business" as contrasted to business that comes "on the peak" (at the time of maximum demand). These terms are self-explanatory, and they are intimately related to the capacity factor because, as we have just seen, fluctuations of output are the chief cause of plants working at less than full capacity. However, it is worth while to distinguish them for some purposes, chiefly because there are some cases in which it is possible to adopt deliberate policies looking ahead and definitely aiming to steady the rate of output, and others in which the behavior of demand is so unpredictable that all that can be done is to treat each week or month of low demand as a problem in itself, trying to mitigate the losses due to unused capacity.

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[1] G. P. Watkins discusses these terms in his book, *Electrical Rates* (New York, 1921), pp. 12–14.

[2] See G. P. Watkins, *op. cit.*

d) *The number of units produced of a given size, type, brand, or model of goods in a given plant.*—This has reference, not solely to increasing the total size and output of the plant, but to the sort of economy a business can secure without expansion, simply by reducing the number of different sizes or models they turn out; in other words, by "standardization." There are costs incurred on account of each size or model that do not vary with the number of units of each size turned out. Such costs are general so far as concerns the different units turned out from one model, though special to this model as over against other models. There are such expenses as molds and patterns, the changing of rolls, the making of drawings and specifications, and part of the costs of storage. Increasing the total size and output of the establishment brings savings on all these scores, but reducing the number of models will also bring them. Standardization is strictly a manufacturing economy. In selling, the most effective use of the salesman's time and talents may still be found where he handles a full and varied line of goods.

e) *The proportion of different products turned out by some central process or plant.*—Wherever two or more different products can be produced more cheaply together than apart, not because of any general savings of increased output but because these particular sorts of product are complementary to each other, there we have "joint cost" in the strict sense. One way of putting it is to say that every added unit of product A makes it easier than it would otherwise have been to produce added units of product B.[1] This principle covers the rotation of crops, packing-house by-products and similar cases of by-products, and may overlap the problem of fluctuating demand, where the kind of service that can be rendered at one time is essentially different from the kind that can be rendered at another time. As, for example, the use of electric current for lighting at night and for power in the daytime.

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[1] See Edgeworth, "Contributions to the Theory of Railway Rates," *Econ. Jour.*, XXI, 558, and Dewsnup, "Railway Rate Theory and Practice," *Pol. Sci. Quarterly*, XXX, 476-509.

f) The size of the single plant.—A large plant, working at full capacity, will usually differ in efficiency from a small plant working at full capacity, on account of the difference in size of the two plants. Normally the advantage is on the side of the larger plant. In most industries, a fairly large concern has a vast advantage over an extremely small one, and in some industries an enormous investment is required in order to obtain standard efficiency. Strictly speaking, this means that there is a different law for every industry and perhaps even a different law for every plant in every industry. However, there are some general principles which can be discovered, and there is always a limit of size beyond which gains are negligible. Sometimes, however, one concern would absorb the entire market before it reached this limit.

g) Integration or vertical combination. Here there are important economies to be had, distinct from the other economies of large-scale production, and they also appear to have their limits. Integration has proceeded far in the steel industry, while the advertising firm and the industrial engineering firm are examples of the opposite tendency; making an independent business out of what used to be simply parts of the work which the management of any business did for itself.

h) Horizontal combination. The combining of plants carrying on generally similar kinds of production (plants that would naturally compete with each other) is another element which commonly makes possible some economies, but which may reach its limit in somewhat the same way as the economy resulting from the size of a plant. Economies in purchasing, in research organization, in giving the larger organization the benefit of the best managerial ability and the saving of cross-freights, are commonly spoken of as savings of this sort, but they may be limited by the difficulty of organization over great distances. Or particular plants may carry standardization farther than they could if independent, each specializing on certain types of goods while the combination still makes it possible for the salesman to "carry a full line." This involves giving up the "saving of cross-freights," so that the management must choose which saving is the greater.[1] These savings should be carefully distinguished from the next law.

i) The extent of competition or monopoly.—This, in itself, has an important effect on productive efficiency, distinct from its effect on prices. Like the previous case it is made up of opposing elements. The savings of horizontal combination may go so far that one all-absorbing combination seems to be naturally more efficient than anything smaller. Moreover, there are wastes of competition as such, which can only be saved by extinguishing it. These are largely wastes of selling tactics. On the other hand, the attempt to gain complete monopoly itself contains elements of waste, chiefly because the would-be monopoly must buy up not only the best plants but the relatively inefficient ones also. As a result, in most cases concentration would probably stop short of complete monopoly even without the compulsion of law.

j) Geographical concentration of industry.—Efficiency also varies according to the output of a given industry in a given town, or district, or nation, apart from the internal economy resulting from the large size of particular plants. Under this general heading come different sorts of gains; some in production and some in bargaining, buying, or selling; some dependent chiefly on the volume of output in a given area and some chiefly on the number of competitors who are concentrated in such an area. They include the "external economies" of large-scale production (increased efficiency in auxiliary industries, development of a generally qualified labor supply, etc.) as distinct from the "internal economies" dealt with under "size of single plant." One important feature of these external economies is that they accrue, not to any one producer, but to all in this industry. The person who creates them does not absorb the main benefit in the same way in which the person who builds up a large plant absorbs the benefit in the way of economy resulting from its size.

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[1] This is discussed more fully in chap. vi below.

k) Geographical density of population and industry in general, in its effect on the general efficiency of the economic system.—This is not a thing capable of definite measurement, for it includes products of different kinds and there is no common yardstick. The dollar will not serve this purpose, chiefly because it is as much a measure of increasing scarcity as of increasing output; as much a token of poverty as of abundance. We have here a general resultant of more intensive agriculture, subject to diminishing returns (which in this case means increasing costs also) and of various internal and external economies in stores, factories, schools, newspapers, theaters, etc. It is clear that civilization gains in economic efficiency from greater density of settlement, considerably beyond the point where agriculture begins to show rising costs, but it would be hopeless to attempt to pick out a point of maximum effectiveness.

l) Degree of co-operation between industries of different sorts, and different industrial groups or classes.—Wherever there are matters of common interest which can be better attended to by joint than by separate action, there is a sort of social overhead cost. Many of these joint activities, including the most fundamental and necessary ones, are carried on by the state, but many remain in private hands. The amount of effective co-operation depends partly on the range of different industries developed within a town or nation, partly on the area over which effective interchange and communication is possible, and partly on the number of different functions which people are willing to handle co-operatively. The nation is the natural limit of most economic co-operation, but for some purposes the economic community crosses national boundaries and establishes a wider area of common action.

6. IMPORTANCE OF DISTINGUISHING THESE VARIABLES

This classification is not by any means exhaustive, but it does indicate some of the chief lines of division between the different problems of efficiency with which economists have to deal. At least this much classification is needed for the sake of clearness. As we have seen, there is one law that determines how intensively it pays to cultivate land under given conditions (proportion of factors), and another law that determines the limits of economical size for farms, and these are two distinct laws. The internal economies of large-scale production must be distinguished from external economies, for they lead to consolidation and sometimes to monopoly while the external economies have nothing directly to do with monopoly (except so far as they consist of internal economies in subsidiary industries). The internal economies come to the producer who is responsible for them, while the external economies are largely free gifts made by single producers to industry in general. One raises the question of cut-throat competition and monopoly; the other raises the question of protection or subsidies to stimulate industrial pioneering which is worth more to industry as a whole than the pioneers can ever hope to collect in profits. It would be confusing to speak of these two very different laws indiscriminately as examples of the law of increasing returns or of the economies of large-scale production.

Again, the case of joint costs or by-products leads to charging what the traffic will bear as between different products, but not as between different persons, and it does not lead to cut-throat competition, provided the industry is in such a state that a proportionate increase or decrease in all the products turned out carries with it a proportionate increase or decrease in costs. What does lead to cut-throat competition and to personal discrimination is the condition in which the general volume of business can be increased or diminished without adding or subtracting its full pro rata share of costs. Competition of packers may bring down the price of various by-products, of bones, horns, and bristles, but it will not naturally go so far that the total income from a steer is less than the total cost of all the processes involved, merely because a large part of the cost is joint.

Unused capacity is another story, and it may lead to cut-throat competition in any business, with or without joint products. The economies of utilizing unused capacity are very great, while the economies of increased size are spectacular only in the early stages where plants are still small. Yet railroads may bid for increased business on the basis of the economies it brings them when they have unused capacity, ignoring the cost of capital on the ground that this is a constant outlay, at the same time that they are raising millions of capital for the enlargements of their plants which their growing traffic makes necessary. Again, an increase of general business is one thing, and off-season business or "off-peak" business, which can be counted on to stay off season or off-peak, is a very different thing. Off-peak business might be profitable at prices that would mean a loss if applied to general business. So it seems that it is of practical value to keep these different variables distinct, aside from the more academic advantages of avoiding ambiguity and sterile controversy. Let us now look more closely at the way in which some of these variables behave, with a view to formulating the laws governing them, so far as they can be formulated in general terms.

CHAPTER V

THE LAWS OF RETURN AND ECONOMY—*Continued*

SUMMARY

Proportion of factors in relation to overhead costs, 86—Plant capacity and steady utilization, 90—Standardization, 96—Joint cost, 98.

1. PROPORTION OF FACTORS IN RELATION TO OVERHEAD COSTS

When the law of proportion of factors is stated, one factor is usually taken to be constant and another variable: for example, a fixed area of land and a variable amount of labor. This means that for purposes of short-run problems, at any rate, land represents a constant cost and labor a variable one. The land is, paradoxically, "overhead." As labor per acre increases, the crop per acre naturally passes through five stages. It may increase (1) faster than labor, (2) just as fast, (3) slower, (4) not at all, or (5) it may actually decrease. The first case represents increasing returns to labor; the second represents constant returns, the third diminishing returns, the fourth zero returns, and the fifth less than zero returns.[1]

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[1] Increasing returns to factor A implies less than zero returns to factor B, constant returns to factor A implies zero returns to factor B, diminishing returns to factor A implies diminishing returns to factor B, and so on through the other two cases. For a development of this mutual relationship, see F. M. Taylor, *op. cit.*, pp. 126–35, esp. 130, 133. Taylor mentions only three stages, corresponding to the first, third, and fifth given here. The second and fourth are, very strictly speaking, only transition stages; nevertheless in many simple and definite mechanical and chemical combinations where there is one best proportion and a minimum of elasticity, all combinations worth considering would approximate either the second case or the fourth and there would be a sudden jump from one to the other. If men are moving dirt in wheelbarrows, each man needs one wheelbarrow. If there are fewer barrows than men, output is limited by the number of barrows and if there are fewer men than barrows, output is limited by the number of men. Even here there is some secondary need for spare barrows, and some other sources of elasticity. In a large plant, if some costs are constant and others vary in proportion to output, then the variable costs represent factors in stage two, and the constant costs represent factors in stage four. Plants are typically in approximately this condition.

But note what the "law of proportion of factors" says of these stages. The fifth stage is manifestly inefficient, and the first, its converse, is inefficient for the same reason. In stage one there is not enough labor to develop the land and what labor there is would raise more if it let part of the land lie idle. Stage two, or constant return, is also inefficient, if land costs anything, because, while the crop per laborer is at its maximum, it would be just as great with a little less land, and so whatever that little land costs is a clear loss, yielding no addition to product. Or with more labor the cost would be less per bushel, since the "variable cost" of labor would be the same per bushel and the "constant cost" of land would be divided among more bushels.

For the same reason stage four (the converse of two) is inefficient if labor costs anything. Therefore maximum financial efficiency is reached after the return per laborer has begun to diminish, but before it reaches zero. The exact point will be the point at which the "variable cost" (differential labor cost) per bushel for the last added bushel of crop is equal to the average cost of the whole crop, including the rent of the land. Thus the "law of diminishing return" holds good, not as a purely technical principle, but as a principle of human choice. The most economical combination is one in which all the factors are in a stage of diminishing return.

Now something very like this happens when a factory of a given size is run at varying rates of output; from next to nothing up to the point where further efforts at speeding up defeat their own ends. Some costs are roughly constant, and so long as a given increase in variable costs produces a corresponding increase in output ("constant returns"), there is increased economy; and the maximum has not yet been reached. This condition is thought perfectly natural in the factory, and unnatural on the farm. Why? Chiefly because a factory typically sets a price and sells what it can at that price while a farm raises a crop and markets the whole crop at whatever it will bring above the cost of harvesting and shipping. Thus one does not think of a farm plant working at part capacity because the market will not take the product at a profitable price, at least not habitually, as is the case with a factory.

Another answer is that the land of a farm is not an indivisible organic unit in the same way in which a factory is. Therefore if one is farming too much land, the mistake can be corrected by letting some of it go, renting or selling it. A factory or a railroad, on the other hand, is an organized unit. It cannot be divided without being partly crippled, nor reduced in size without becoming qualitatively different from what it was, and a less effective instrument. A single-track railroad running four trains a day each way is more efficient than a similar road running only two trains. But if this gain were merely a matter of proportion of track to trains, the two-train road could have secured it by making its original investment smaller. This would have meant a narrow-gauge road; more fully utilized, to be sure, by smaller trains and more of them, but with a corresponding waste of the train-crews' labor, and the further burden of a costly added transfer to connect with the standard-gauge system of the rest of the country. Thus it may pay to incur the inefficiency of two trains a day rather than the inefficiency of a narrow-gauge line.

It is often necessary to weigh incomplete utilization of an efficient type of plant against full utilization of a plant so small as to be inefficient. And one of the fundamental reasons why a small plant is so often inefficient is that it fails to utilize the full supervisory power of that indivisible element, man, when he might have more powerful iron slaves at his disposal. There are many reasons why so many manufacturing concerns are smaller than is necessary for maximum efficiency. One is the number of concerns that have made small beginnings in the hope of growing to maturity, and another is the fact that the standard size has been growing, in harmony with advancing mechanical methods, so fast that it is hard for concerns to catch up.

On the farm this particular disturbance to the law of proportions does not commonly arise, because in most branches of agriculture a moderate-sized one-family farm can be about as efficient as a very large one, so that there is not the same necessity for taking up more land than one can cultivate that there is for building a standard-gauge railway even if one cannot find traffic to utilize it adequately. Moreover, a farmer is never limited by the extent of his market as a railroad is, or even as a manufacturer often is; his market is not his own private affair, and his output has no perceptible effect on the total supply and cannot possibly produce a glut all by itself; therefore it pays him to raise all he can and sell it for what it will bring.

Nevertheless, proportion of factors has something to do with size even in farming. The methods of extensive cultivation (little labor on much land) lend themselves to larger farms than do the methods of intensive cultivation, largeness being measured not merely in area of land, but in total gross output, or any other rational measure of size. This is because extensive farming can employ machinery for its cruder and less discriminating operations, and can use hired labor with less loss of efficiency or less need of eternally vigilant supervision. Furthermore, on small farms efficiency is almost typically limited by inability to get enough working capital for the minimum efficient working force--commonly the farmer's own family. Here is an inefficient proportion of factors. More capital would bring "increasing returns." But it is hard to get more capital, and the proportion cannot be improved by reducing the amount of labor without reducing the working unit to an inefficient size.

There is another reason why, in manufacturing, plants are not commonly working with just the output (and just the proportion of factors) that means the greatest efficiency. Fluctuations of demand make the operations irregular, and the size of the plant cannot adapt itself to them.[1] Does this affect farms? They are exempt from weekly or monthly fluctuations of demand, but there certainly are good and bad years in different branches of agriculture, and to some extent years of heavy or light planting; yet the size of farms (and of the farmer's family) cannot adapt itself with perfect elasticity. There are undoubtedly important parallels between agriculture and manufacturing in this respect, as well as important differences, but a search for them at this point would lead too far afield.

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[1] See Taylor, *op. cit.*, p. 151; cf. also Torrens, *On Wages and Combinations* (London, 1834), p. 63.

To sum up, we have seen that the law of proportion of factors and the law of efficient size of output are distinct principles, but related to each other. Where one of the factors is an organic unit, which cannot be made smaller without changing it into a different and less efficient kind of instrument, this fact may set minimum limits on the efficient size of an establishment.[1] Nevertheless, a manufacturing plant may be in a stage of increasing efficiency with increased output, and decreasing returns with reference to the proportion of factors, both at the same time, and a farm may be in a stage of decreasing return with intensity of cultivation while an increase in the size of the farm would yield increasing economy of production.

2. PLANT CAPACITY AND STEADY UTILIZATION

What is the "capacity" of a plant? Business men use the term constantly, and yet no absolute figure can ever be set. The term never means the utmost limits to which production could be pushed; there is always some "overload capacity." The forces that set the limits on capacity are various. In electrical generating machinery the limit is set by overheating, with the result that the machinery can be run for a few minutes at a faster rate than it could stand as a regular running speed, because it takes some time to raise the temperature to the point of injuring the machinery. In the case of ordinary manufacturing there are three main ways of increasing output; namely, working more shifts, working a given shift longer hours, and speeding up the pace of the work. This is a little like the temporary overloading of a dynamo, in that when labor works excess hours, or works at undue speed, there is an accumulation of fatigue, although the result is a matter of days and weeks instead of minutes.

If we work our labor force overtime we shall probably have to pay them higher wages per hour for the extra work, or they may get tired and not work as effectively, while a night shift is notoriously less efficient than a day shift. So in one way or another we shall find that the cost of operation increases. At some point there will be a balance between the increasing cost of operation and the economy due to more perfect utilization of the machine itself. At that point the differential cost of added output will be equal to the average cost, including all overhead costs on account of the machine itself. Beyond that point, it will pay to get more machines. This point might furnish a theoretical measure of capacity, but one that would be hard to apply. It would be a zone of some width rather than a point, and in the long run it would call for a working day considerably shorter than would pay for a short spurt.

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[1] See F. M. Taylor, *op. cit.*, pp. 134, 141–42.

For practical purposes, capacity must be measured according to what is a customary length of working day for the machinery, which may be anything from eight hours a day to twenty-four. Thus in a plant where eight hours is the standard operating day, normal capacity would mean eight hours' output, and this could be increased by putting on a second and a third eight-hour shift, while a plant already working two shifts does not have the same reserve of producing power. The same principles apply to standard or satisfactory speed, meaning, as nearly as can be determined, the maximum speed which it pays in the long run to try to secure. Presumably, the ideal of the efficiency engineer would be the highest speed that could be maintained year in and year out, that is, without producing cumulative fatigue; but nobody knows exactly what this is, and working estimates must needs be governed by customary practice.

In considering fluctuations in the utilization of a given plant, all costs depending purely on the size of the plant will remain constant. This would include taxes, interest, and for practical purposes, insurance, depreciation, and general expenses. The critical question, however, is how the variable costs behave, and what the limits of increased output are. This depends on a number of circumstances, including the question whether it is a short-run or a long-run problem, and whether the output of this particular plant is low at the same time that industry in general has reached the low stage of the business cycle, or whether it moves independently. It also depends on whether the industry uses time wages or piece wages.

For instance, in an industry which does not use a piece wage but hires by the day, it may not be practicable to reduce the working force every day when business happens to be slack, and take men on again at a moment's notice when business becomes heavier. Under such conditions, operating expenses may not vary at all with reference to very short-run fluctuations in business, up to the point where the force has to work overtime or where green men have to be hired. When that point is reached, expenses will take a sudden upward jump, increasing much more than in proportion to the business that created the overload. Yet if business were to fall off and remain steadily low for an entire month, the working force would be cut down, or if business remained high for an entire month, more men would be taken on and given a modicum of training, overtime would be avoided, and operating expenses would increase little, if at all, faster than volume of business.

In a force of day-workers, there is some elasticity in the amount of work a given force will do in any one day or week, and therefore some margin between the point where some workers would be laid off, and where additional ones would be taken on. A temporary overload might not cost the employer anything in extra wages for the moment. And often when the strain at one point goes beyond these limits, it can still be met by calling men from other points where the load is still within this elastic margin of tolerance. Thus a large mail-order house shifts "order-pickers" as they may be needed from groceries to dry goods or hardware or elsewhere in its array of different branches of merchandise, but any general increase in business will require overtime or an increase in the force.

Postponable work offers interesting possibilities of mitigating the effects of fluctuations. Such work may be directly remunerative, so that if it is postponed it amounts to postponing output as well as costs. Some, like maintenance, may be indirect, so that output goes on for the time being virtually undisturbed. In some cases, output may be more interrupted by making repairs than by letting them go, so long as the machinery will work at all. So far as repairs can be concentrated in slack times, the waste of irregular operation is mitigated. For most purposes, however, such work can be put into the time before and after regular working hours, and would not be held for a period of slack business; nevertheless, the use of postponable work has many possibilities.

In this respect the managing staff stands on a different footing from the rest of the force. The executives commonly work overtime without excess pay when overtime work is needed, and in slack times they not only shorten their hours but catch up on certain kinds of postponable work which has been allowed to fall behind in the pressure of filling urgent orders. It is in dull times that operating systems are overhauled and inefficient methods weeded out. There is a natural deterioration in standards of work which it requires eternal vigilance to correct, and this deterioration is often allowed to go on in busy times and checked up later when the staff has more time. Thus, while the general expenses of the managing staff may show no change, with moderate fluctuations in business, there is an imponderable cost which escapes the books. The business done in rush times is not quite so profitable as the books will naturally show, nor are the expenses incurred during slack times all chargeable against the small volume of business that is then being done.

Another disturbing fact is that, when men are being laid off, the ones that are left work harder for fear of losing their jobs, especially when industries in general are also laying off men, so that the loss of a job is a more serious thing than in active times. The Ford Motor Company, after its shutdown of 1922, turned out more work with 40,000 men than with 57,000 before the shutdown.[1] A contributory cause is the fact that the most capable workers are kept, and that some superior men are shifted to inferior jobs commonly held by far poorer workers. More than one case is on record in which the force was cut twice and both times the total output increased instead of decreasing.[2] In general, the behavior of operating expenses represents chiefly a compromise between savings due to this fact and wastes due to the loss of proper proportion between the different parts of the working force: between the cutting edge of the tool, so to speak, and the auxiliary services of power, transmission, storage, planning, supervising, and what not. Because these forces are so complex, differing from plant to plant, no generalization can be made as to just how the curve of operating expense behaves when plants work at different percentages of their normal capacity, except the fact that when the overload becomes great, cost always increases faster than output.

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[1] See Paul H. Douglas, "Personnel Problems and the Business Cycle," *Administration*, July, 1922, p. 22. The company turned out as many cars as before and "many more parts."

[2] *Ibid.*, pp. 22–23. Numerous cases of increased output per man are cited.

In general, probably, we should not be very far wrong if we made a careful estimate of costs which do not vary at all with changes in the capacity factor, and then took for granted that other costs varied in proportion to output up to the point of congestion. On some such basis as this, Ripley estimates for railroads that two-thirds of the expense of maintenance of way and structures are constant, half of maintenance of equipment and conducting transportation and all of the general expenses, making about 55 per cent of the total operating expenses.[1] In most businesses, the percentage of constant operating expenses would not be so high.

From what has already been said a reflective reader would deduce that, aside from any loss of efficiency due to working a plant at less than full capacity, change itself brings either gain or loss, and probably more often loss. When a cut in the force increases the per capita output from 35 per cent to 120 per cent, this looks like a spectacular gain, but there is an unseen debit. One reason why there is so much room for increase is that men nurse their jobs in order to postpone a possible cut in the force as long as possible. Thus the fear of a cut leads to soldiering before the event and speeding up afterward, and the loss undoubtedly exceeds the gain. It would typically be more expensive to run a plant where the output constantly fluctuated between 60 per cent and 120 per cent of its normal capacity than to run steadily at about 90 per cent. Corroboration of this is found in the fact that large combinations find it economical to concentrate the fluctuations in particular plants.

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[1] Ripley, *Railroads: Rates and Regulation*, p. 55.

The United States Sugar Refining Company concentrated its fluctuations in a large refinery in Brooklyn.[1] The Carnegie Steel Company has a huge by-product coke plant at Clairton, near Pittsburgh, which does not supply all the coke the company needs in active times, so that it can be kept running at full capacity, together with a fleet of towboats and barges which bring down coal from the company's mines farther up the Monongahela River. The fluctuations are taken care of by beehive coke ovens located nearer the mines. Deplorable as it may seem that there should be any beehive ovens, it is certainly more economical, if they must be used at all, to use them in this way. This kind of economy seems to be one of the recognized advantages of horizontal combination.[2]

One way of expressing this fact is to say that machines thrive best and perform best under monotonously continuous operation. Their ideal would seem to be perfect regularity, but it does not follow that this is an economic ideal which human beings can safely adopt. If we could achieve it completely, we might be better working engines, but we should hardly be better men. Where irregularities can be taken care of by changing the pace or shifting to postponable work, they probably do no real harm, and may do some good, particularly to the men who are shifted from one job to another and so broaden their experience. Man, like any animal, works better when he is not required to hold a mechanically even pace through every minute of the day or every day of the year. But the kind of irregularity we now have goes a great deal farther than that modicum we need to keep us human, and almost any reduction that can be secured will be a much needed relief.

Among the costs of irregular operation, besides those already mentioned, are the undue postponing of repairs, the increased turnover of labor, and the increased waste of materials due to the pressure of rush work.

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[1] Jenks, *The Trust Problem*, 1911 ed., p. 35.

[2] Besides the passage from Jenks, already referred to, it is mentioned by Marshall and Lyon, *Our Economic Organization*, p. 202.

3. STANDARDIZATION

Standardization is one of the most pervasive terms in the lexicon of business. There are standardized products, standardized machines, standardized processes, and the satirist of *Main Street*, Mr. Sinclair Lewis, is doing his best to convince us that business is producing standardized people. We are speaking here of standardized products. The purchaser does not want to be limited to standardized products, and the selling force which is in touch with the purchaser's demand is under continual pressure to gratify some purchaser's desire for a slight variation from standard in size or shape or in some minor feature of design. But the machine does not want to turn out a varied product. If it is making screws, it wants to run all day on one size of screw, because if it makes half a dozen or more different sizes in the course of a day, it will spend too much of its time being readjusted. The cost of adjusting it is a constant cost so far as concerns the number of screws it turns out before it has to be adjusted again.[1] Jenks quotes an estimate that the American Steel Hoop Company, by dividing up its eighty-five or ninety sizes and varieties so that each plant specialized in one group of products, was able to save from a dollar to a dollar and a half per ton, simply by avoiding the need of frequent changes of the rolls.[2]

Furthermore, when sizes and models multiply, storerooms become crowded. More goods have to be kept in stock to be equally sure of filling an order. Furthermore, special models are likely to remain in stock long after there has ceased to be a demand for them and the salesman who asked for them has forgotten that they exist. For all these reasons, the production departments have decided that economy demanded a reduction in the number of sizes and models, often with startling results in the way of ridding the stockrooms of dead lumber.

The result is a form of contest between the purchaser's preference and the producer's search for economical production.

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[1] See Redfield, *The New Industrial Day*, pp. 84–85, cited in *Annals of the American Academy of Political and Social Science*, September, 1919, pp. 127–28.

[2] *The Trust Problem*, 1911 ed., p. 37.

If cost accounting methods were perfect, this contest would settle itself automatically, since the purchaser of a peculiar size or model would pay the full extra cost for which he was responsible, including the cost of interrupting other work. Apparently, concerns have not had the hardihood to fix prices on such work in proportion to its true differential cost. The outcome appears to be a tendency to divide producers into two kinds, those who make standard sizes and those who do a custom-order business.

Standardization is related to size of plant and to horizontal combination in quite a definite fashion. Mechanical production in its simplest forms involves a high degree of standardization as compared to the handicraft methods that went before, and great increase in the size of the productive plant. The farther standardization proceeds, the more elaborate machinery it pays to introduce, and the heavier becomes the proportion of indirect costs. This tends to intensify competition, converting it into cut throat warfare and thus strengthening the urge toward combination.[1] When a combination is formed they frequently find that they can gain economies by specializing their plants. The combination has an advantage over a number of independent plants, because it can offer a more complete "line" of goods and so mitigate or avoid the chief weakness of standardization; namely, its failure to gratify the consumers' demand for a wide variety of goods. Thus if independent plants were to standardize, they would often be driven to combine in self-defense in order that their salesmen might "carry a full line."

It is worth noting, however, that there are other traditional savings of combination which hinge on not carrying specialization of plants to its ultimate limits. If one type of goods is made by only one plant there are heavy freight bills to pay, which could be reduced if every order could be filled by the plant nearest the customer, thus "saving cross-freights." Furthermore, fluctuations of output cannot be confined to one plant unless that plant produces all types of goods. The dovetailing of different kinds of production in order to avoid the evils of seasonal operation is another economy which can only be had by increasing, not reducing, the variety of goods turned out by one plant. Varied farming makes it possible to distribute the work of the farm more regularly through the seasons, and this represents a serious drawback to unduly standardized agriculture. Thus the principle of standardization, like all the principles we are studying, encounters opposing forces which set limits upon it.

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[1] See Homer Hoyt, "Standardization and Its Relation to Industrial Concentration," *Annals of the American Academy of Political and Social Science*, March, 1919, p. 271.

4. JOINT COST

As has already been pointed out, true "joint cost" occurs where efficiency varies according to the proportion of different products turned out from one central process and where it is cheaper to turn them out together than separately.[1] There are two main types or stages of joint cost, in one of which the proportions are adjustable, as for example, adopting different kinds of crop rotations, or different breeds of sheep, some of which are better for wool while some are better for mutton. In the other type, the proportions cannot be adjusted except by leaving some useful material to go to waste, as for example, the proportion of hides to beef after the steer has been slaughtered. Petroleum products would seem to belong naturally in the second class, but under pressure of an insistent demand for more gasoline, the proportions have been altered, in part by merely shifting the limit of tolerance separating gasoline from the heavier and less volatile products, but partly also by new processes of "cracking" the heavier fuel-oil constituents of crude petroleum and so definitely altering the molecular structure and increasing the available amount of light and volatile fuel. Here, as in the case of wool and mutton, and of crop rotation, the different products are in part complementary to each other and in part rivals. So far as the supply of gasoline is increased by refining more crude petroleum, the more gasoline is made the more of the heavy oils will also be forthcoming. But so far as gasoline is increased by the "cracking" process, the more gasoline is extracted the less of the heavy oils remains.

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[1] See chap. iii, sec. 15, above.

Now, so far as different products are rivals they lack one characteristic feature of joint products in the strict sense, because the increased production of one does not help to increase the production of the others, but rather sacrifices some of the others. But if, after the proportion of one product has been increased as much as possible, there still remains an irreducible minimum of the other available for working up, that minimum would have every characteristic of a joint product, for all its cost would be chargeable to the business as a whole. There would be no special or differential cost except the cost of working up this material and putting it on the market. If a breed of sheep is chosen with reference to mutton alone, and raised on the same principle, there still cannot help being some wool worth shearing, and this value is a clear joint product, and its cost is wholly a joint cost.

To take a simplified illustration, if oats and alfalfa can be raised in rotation cheaper than separately, then the differential cost of oats, plus the differential cost of alfalfa, is less than the whole cost of the rotation, and there is a margin of joint cost which will be divided between the two crops in whatever proportions they can bear. If the rotation were actually to yield more oats per dollar expended than when oats were grown alone, the alfalfa could be given away without loss.

On the other hand, when we have two possible rotations of oats and alfalfa in different proportions or varied rotations of different cereal, leguminous, and root crops, or when we are comparing the old method of refining petroleum with a new process of "cracking" the heavy oils, the case takes on a new aspect. By the cracking process, for example, if it is practicable at all, the yield per $100 expended will be more gasoline and less heavy oil.[1] On this basis a sort of rate of exchange could be drawn up between gasoline and heavy oil. Then if the market price of gasoline, compared to the heavy oil, is higher than this production exchange ratio, it will pay to use the cracking process; if lower, it will not pay. In such cases, where there is a fairly wide and elastic choice of methods, there does not appear to be any important element of expense that cannot be allocated. However, if the choice of available methods is narrowly limited, the separate cost of each product may be indeterminate between fairly wide limits, and a large part of the cost of the whole process may be "joint."

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[1] The cracking process turns some kerosene into gasoline and some of the heavier oils into kerosene, so that the *chief effect* is as if heavy oil were turned to gasoline.

So far we have been speaking of those stages of the process where there is still a choice of methods. In the second stage of the process, after the crop has been planted or the oils cracked, there is no more elasticity. The price may go down until it reaches the direct cost of working up a given material rather than letting it go to waste. Anything above this makes it more profitable to work it up than to throw it away, and contributes something toward the common costs of the whole chain of processes. Here we have a case where a large part of the cost is not traceable, and must be apportioned on the basis of what the traffic will bear.

As we have already seen, east-bound and west-bound traffic on railroads furnish another case of joint cost. They are essentially complementary and you cannot haul an added car east without being forced to haul it west again, empty if it cannot find some cargo. Every haul of an empty car represents a possible joint product undeveloped. The special cost of west-bound tonnage is merely the excess cost of hauling cars full over hauling them empty, and the rest is joint. It is clear that a railroad may be in a good or bad position not merely in having an efficient plant or in having adequate or inadequate traffic for it, but also in having a balanced or unbalanced haul, and no matter what is the efficiency of the plant or the volume of traffic, the road will gain in efficiency if its east-bound and west-bound tonnage balance, and lose if they do not.[1]

The hours of day and night may give rise to a case of true joint cost because freight can move at the dead hours of night when passenger traffic drops to little or nothing. However, freight can also move in the daytime, and most roads have so much freight that a great deal of it has to move by day, so that the question becomes one of providing enough tonnage for the combined volume of freight and passengers. A more genuine issue is the seasonal cycle of traffic. A given yearly traffic could be handled with less plant and equipment if the road could dictate just how it should be divided among the different seasons. Additional off-season business costs far less than additional business in general.

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[1] An exception might occur where east-bound tonnage requires a special type of car wholly unadapted to carrying the kinds of goods that move west bound, or where the cost, e.g., of cleaning the car and protecting the cargo is prohibitive. Ore cars must be carefully cleaned before they are allowed to carry coal, or else they will discolor the coal and reduce its selling value.

A clearer case is found in the public service industries. Residential lighting comes chiefly at certain hours of the day with its heaviest "peak" in the evening in winter. If current is to be used fairly regularly throughout the day it must be for power or other purposes than lighting. Thus the efficiency of an electrical power plant depends, among other things, on the proper proportion between two essentially different products, namely, residence lighting and power, or between current taken at ten in the morning and at five in the afternoon. Small plants or large gain equally by securing steady utilization. Here the investment is governed in the long run by the size of the "peak load": the heaviest half-hour or so of demand which it has to stand ready to meet.

Are freight and passengers joint products of a railroad? We have already seen that they are not, but it may be worth while to emphasize the fact by an illustration. If we have a number of parallel railroads serving a common traffic, such as the through traffic between New York and Chicago, would it be more efficient for each railroad to carry a given share of passengers and a given share of freight, or for one or two railroads to specialize in the passenger business and leave the freight for the rest to handle? Does the taking on of an extra hundred thousand tons of freight contribute toward facilitating the taking on of extra passengers in the same way that killing an added hundred steers for the sake of the meat contributes toward the production of more hides and other by-products?

Clearly it does not, but rather the contrary. The carrying of freight and passengers together on the same line is, of itself, an element of inefficiency, because of the different speeds at which the different types of trains need to run and the separate terminals they require. This handicap can be minimized on a four-track road, but never disappears entirely. It would be more efficient, if it were practicable, to devote one line to passengers and other lines to freight. This was done to some extent during the federal administration of the railroads. The reason why it cannot become a general policy is simply that local communities must receive both kinds of service and have not traffic enough to make two railroads necessary or efficient. Specialization would be a gain, but it could be gotten only at the sacrifice of the advantages of size, which are much more important.

Is there any connection between joint cost and the economies of large-scale production? There is a very definite connection, which may be stated in this way. Materials for main products and by-products will be present, some in large amounts and some in small. If the business gradually grows in size, these different products will reach the scale necessary to standard efficiency at different times. Typically, some of the minor by-products will still be present in such small quantities that they cannot be economically worked up, while the main products are already being turned out on a large enough scale to make possible most of the economies that come from size. After the main products have achieved all the economies of size, minor products would still be working materially short of the point of maximum efficiency, and the whole plant would still tend to expand. Thus the economies of large production tend to push the size of a joint establishment much farther than they would if every process stood on its own feet: much farther than is needed for the sake of efficiency in the main products alone. To make the weak links stronger, the whole chain is magnified tenfold.

Where the main product itself is turned out in small quantity, the minor materials would frequently have to be worked up on such a miniature scale and at such inordinate expense that it would not pay to utilize them at all. For this reason it is commonly said that savings from utilizing by-products constitute one reason why large-scale production is cheaper than small. This is true, granted that there is some other and independent reason why large-scale production *of by-products* is more economical than small, and then it simply means that the economies in the by-products reinforce those in the main processes. In some cases even a small business unit can get the important savings that come with joint production. Rotation of crops is a case of joint production, but it does not necessarily mean the growth of extremely large farming units. If that comes, it will come for a different reason. Nor is it a cause of cut-throat competition among farmers or of personal discriminations in their selling prices.

If the demand for one crop in a rotation increases it will be possible to sell the crop at a higher price. If the result is to increase the acreage devoted to this entire rotation, it may increase the supply of the complementary crops and lower their price, so that an increase in the demand for one crop may lead to a lower price for the others. The prices of the different crops are dependent on the demand rather than on their separate costs of production, within certain limits, beyond which farmers would be led to alter their systems of rotation. This may in some cases create a fairly wide margin within which prices would not be governed by a separate cost of production for each different product. But this is not discrimination nor cut-throat competition, and requires no special measures of control. If there is cut-throat competition in farming, it is due to other causes. Even in manufacturing, joint production can in some cases be carried on by enterprises of moderate size in reasonable competition with each other, selling different kinds of products at different prices, but not discriminating arbitrarily between different customers, nor engaging in general cut-throat competition.

In conclusion, it has not been possible to make an exhaustive study of the various laws of return. The next two chapters will take up at some length the economies due to increased size of plant and different forms of combination, and some of them will be more fully illustrated later in connection with railroads. However, enough has been said to show that these laws are distinct, and also that they work together, reinforcing each other, all of them contributing to the tendency our business world is showing to expand into larger and larger interests, more and more intimately bound up with each other.

CHAPTER VI

HOW AND WHY LARGE PLANTS BRING ECONOMY

SUMMARY

Motives to expansion versus economies resulting, 104—Basic economies of factory production, 105—The general law of mechanical improvements, 107—Physical economies of large mechanical units, 113—Unused capacity of parts of a complex plant, 118—Knowledge as an overhead cost, 119—Further division of labor, 123—Reduction of risks by consolidation, 126—Economies in buying, 127—Economies in selling, 128—Advantages in financing, 131—Disadvantages of size, 131.

1. MOTIVES TO EXPANSION VERSUS ECONOMIES RESULTING

Perhaps one should ask two questions about these economies rather than one, namely: What were the impelling motives to the development of large plants, and what are the economies which result after large plants have been built? Frequently the difference between the two would be merely the difference between gains expected and gains realized, but frequently also it would be something more than that. Business expands under pressure of the economies of full utilization of existing plants. Business men become accustomed to thinking of the value of added business in these terms, and continue pushing sales, until a larger plant becomes necessary. The economies resulting from this increase may be nothing like as great as the previous economies of fuller utilization; in fact, if the plant grows piecemeal without having been carefully planned to make such growth possible, the result may be an increase rather than a decrease in costs.[1]

For example, we have seen that railroad men appear frequently to think of the cost of added traffic as very low, because a road can nearly always carry a little more without increasing the fixed plant and equipment or the "constant" operating expenses. And they continue to think in these terms even at the moment when they are enlarging their plants to handle the growing traffic and are getting little or no economies from the increase.[1] To some extent it would be fair to say that the economies governing traffic policy are chiefly those of increased utilization of the existing plant, while those that actually result are chiefly the long-run economies of increased plant, and that the latter are far smaller than the former, so that policies of increasing traffic are based partly on expected gains that cannot in the long run be realized.

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[1] See papers by H. H. Titsworth and Henry T. Noyes in *Annals of American Academy of Political and Social Science*, September, 1919, pp. 63–65, 68–69.

Especially is it true of large consolidations that the motives are likely to be different from the realized economies, for the motives include promoters' profits and the gains of partial or complete monopoly. In the present chapter, however, we shall be dealing with the large single plant, reserving the subject of combination for the following chapter.

2. BASIC ECONOMIES OF FACTORY PRODUCTION

It is one thing to increase the output of a business from almost nothing to moderate size, and another thing to increase further the output of a business that is already quite large. In general, different forces are at work in the two cases, or at least the important forces are different. An output so small as to be next to nothing is always wasteful to produce, and this is so obvious that we naturally take it for granted. Adam Smith explained the fundamental reason as well as it can be done when he explained the advantages of the division of labor and showed how it is "limited by the extent of the market." Nobody can produce anything efficiently until he becomes a specialist in producing it, and he cannot become a specialist until he can make it his chief business in life to turn out that one product. He can become still more efficient in some part of the job if he can concentrate his time on that, but in that case there must be enough goods turned out so that he can afford to devote his whole time to one part of the process while other people are doing the same for other parts.

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[1] See concluding paragraph of chap. iv, above.

A village has to grow to a certain size before it pays one man to spend all his time making shoes; but it requires a huge national market to make it worth while to divide shoe-making into one hundred and ten separate processes with specialists spending their whole time on each one. Pin-making in Adam Smith's time was in an intermediate stage, for there were eighteen processes, but Smith found a factory employing only ten men. These men were already using "machines," but obviously not the automatic power-machines of the present day. In any case, however, the subdivision of labor so simplifies each man's task that it can be done by a machine, and so makes the machine inevitable. Some machines have taken over whole crafts; crafts of some difficulty and skill. The spinning-jenny did this, and the power-loom. But these were the great inventions of the brief heroic age of the industrial revolution, and the tribute of respect we still pay them is witness to the fact that such achievements were rare.

The moment we pass from a tool to the simplest kind of a machine, we have a new servant who is even more of a specialist than the laborer and it takes a still larger output to make it worth while for us to devote this specialist to one particular kind of work. He has such a decisive advantage over the ordinary laborer that it may pay to use him even though we cannot keep him busy all of the time. He puts the strength of steel in place of the strength of the human tissues and multiplies the power of men's muscles by the principle of the lever and the screw, or harnesses the fall of rivers or the push of expanding steam. His fingers are never unsteady and he always makes the same motion in the same way, no matter how many times he has to repeat it or how rapidly he works. He can do many kinds of things that are practically impossible for ordinary labor. In somewhat the same way chemical reactions will do things that cannot be done by mere mechanical force, but it always takes a certain amount of specialized apparatus to carry on the processes of industrial chemistry, and this is merely another sort of machinery.

The machine can have a hundred hands, each equipped with precisely the tool for the next operation, so that it never has to lay tools down or pick them up. It has virtually unlimited strength and can force metal into a mold or die at a single blow, shaping it in a fraction of a second more accurately than a craftsman could after long and painstaking effort. It can strike any number of blows at once without needing to look and take aim, and can do things in twenty or two hundred different places at once, all with absolute accuracy. It can work so fast the eye cannot follow the motion, and always with the same precision. It relieves man of the burden of moving his materials from one process to the next, and by feeding them to the worker it incidentally sets his pace for him with an inexorable insistence.

When the machine takes over a process which a laborer used to perform, it still commonly requires a laborer to tend it, so that the outlay for this one process is not diminished, but rather considerably increased. To make a saving, the output must be increased at least in proportion to this increase in cost, while the speed and tirelessness of the machine make it able to increase output vastly more than this. It might, for instance, cost as much as five men and be capable of doing the work of fifty. But this would really mean more than a fifty-fold increase in output, because, as in Adam Smith's small pin factory, some men performed two or three processes, putting only part of their time on each, while the greater overhead cost of the automatic machinery made such a part-time system too wasteful to be tolerated. Persons being indivisible, it is small wonder that the size of plants increased, and small wonder that Henry Adams sought the historical formula for the nineteenth century in a geometrical progression; man's application of power doubling every decade.

3. THE GENERAL LAW OF MECHANICAL IMPROVEMENTS

The quantity and quality of equipment which it pays to instal depends on the amount of use that will be made of it. It may not pay for a settler to lay a water pipe to save carrying three pails of water a day from a spring a few hundred yards from his camp. If the camp grows to a tiny settlement, it may pay to lay some sort of a trough or pipe to save the carrying of one hundred or more pails of water every day, and if the little settlement grows into a town, it will pay to instal a reservoir with underground pipes and perhaps a pumping systêm. A pipe is a fixed expense and the work of carrying pails of water is a variable one, and the fixed expense is for an equipment which makes variable expenses unnecessary. This is the type of all labor-saving machinery and all enlargement or development of labor-saving equipment. The saving is measured by the cost of carrying each pail of water multiplied by the number of pails that have to be carried. If this amount bulks large, it would pay to instal a considerable equipment to avoid it, while if it is small, the equipment may be uneconomical.

The general rule governing all such questions of policy may be put in this form. Most labor-saving devices of a mechanical sort call for an investment in some sort of machinery or equipment and by means of this investment the labor costs of operation can be reduced. In other words, it is an increase in "fixed costs" which is to be balanced against a saving in the direct cost of operation which, for one given plant and within the limits of its capacity, vary roughly with the amount of output. There are three principal quantities which determine whether it pays to make the change or not. The cost of the fixed instalment may be large or small. The saving on every unit of output that can be turned out by its help may be large or small. And the number of units of output on which this saving is made may be large or small.

If the invention is one that means a huge saving, it will pay to use it even if there is not enough business to keep it busy all the time or even a large fraction of the time, or to use it to anything near its full capacity. Some devices may involve such an extremely large saving that they come to be regarded as fundamentally necessary to anything like efficient operation. The patterns of a foundry are an extreme case of a form of equipment which is so necessary that the foundry cannot do without it even though it is idle most of the time. The minimum plant of a single-track railway is a less extreme case. Other devices are so important and bring so big a saving that plants of moderate size instal them even though they can only be used to a fraction of their total capacity, although an extremely small plant might not find them absolutely necessary. Lastly there are devices that bring only a slight saving, and these devices will not generally pay to use at all unless they can be worked very nearly up to their full capacity. Such things are generally improvements on the quality or increases in the size of the working units of the more fundamental machinery (for example, bigger cars or heavier rails), or subsidiary devices installed for the sake of various minor economies, such as the saving that is gotten from a slight reduction of the ruling grade or of curves on a railroad.

Whenever any equipment is working at less than its full capacity, there is, of course, a loss in efficiency, or rather, the full efficiency has not yet been reached. But there are two kinds of saving gained in connection with most introductions of mechanical equipment. The first comes when the new device is introduced and begins working, generally short of its full capacity, and sometimes very far short. The second comes with such growth in output as enables this machinery to be used more nearly up to its full capacity. The second is the chief kind of saving we get a chance to see going on, in the case of the big fundamental and necessary kinds of equipment, such as the minimum outfit of roadbed, rails, and rolling stock for a railroad. The introduction of this equipment can happen only once and the saving is so great that it pays for the investment, even on a small traffic. Before the recent revolution in prices, the cost of moving goods, by road, ranged from 15 to 30 cents per ton-mile,[1] and the average operating cost on railroads was about half a cent per ton-mile. Another three-tenths of a cent per ton-mile furnished, on the average, the return on the investment. Traffic might be so sparse that a railroad worked at only one-twenty-fifth of average (not maximum) efficiency and it would still be cheaper to move goods by rail than by wagon, and enough cheaper to pay for the investment. Thus it paid to build railroads long before there was traffic enough to utilize their capacity efficiently, and there was a long period after the first construction when any increase in utilization was almost clear gain.

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[1] From an investigation by the United States Department of Agriculture, published in 1907. Mr. Charles Whiting Baker estimated in 1919 that before the war the cost of hauling farm produce on country roads was 25 cents per ton-mile, while motor-truck costs ran from 12 to 25 cents (*Engineering News Record*, July 10, 1919, pp. 52-53). These estimates presuppose good roads. Average costs today are probably nearly twice as great. The figures are supposed to cover interest on the carrier's investment, but nothing for the highway. For the purpose in hand, there is no harm in comparing these costs with rail rates, even though they are not strictly comparable, remembering that a motor highway that will "stand up" under trucks requires an investment of $25,000 per mile and upward. Many early railways cost less than this, though they could not be reproduced for that sum now.

Since traffic was so sparse at first, it did not pay to put in any equipment that was not absolutely necessary. Trestles were of wood, ridges were crossed by switchbacks instead of by tunnels or deep cuts, grades were steep and "pusher engines" were used on the worst ones, or trains were cut in two and taken over in sections, and the general character of the early equipment was hit off in the phrase: "two streaks of rust on a right-of-way." As the traffic grew, it became economical to put in tunnels and cut down grades for the sake of the saving in operating expenses, though it might have been positively wasteful to do this at the very first. Thus the growth of traffic brought one sort of economy in the increased utilization of the plant which was already installed and another sort of economy from the larger and better fixed plant which the larger traffic made it profitable to put into use.

This adaptation of equipment to volume of business is a commonplace in railroad construction. The weight of rails and smoothness of the track, the quality of the ballast and its up-keep, the steepness of grades and sharpness of curves, and the size of locomotives and cars, all depend upon the density of the traffic, that is, they do if the railroad is economically constructed. The Virginian Railroad might be cited as the exception that proves this particular rule. "The late H. H. Rogers, the promoter and owner, a wealthy financier with no experience in railroad matters, desired to have a coal carrying line far superior to any other in the land."[1] The result was a single track road with grades and curves well-nigh eliminated, but at a cost of about $176,000 per mile for road and equipment,[2] or nearly three times the average for all the railroads of the country at that time. In 1910 the road commenced serious operations as a carrier, and in the next three years failed to cover its fixed charges by more than three and a half million dollars, in spite of the fact that operating expenses absorbed less than 64 cents of every dollar of earnings, leaving an unusually generous proportion to cover fixed charges. Bonds were reduced and with growing traffic the road showed a phenomenally low "operating ratio." A considerable surplus was accumulated, though dividends were not paid except in 1917, the last year before federal operation.

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[1] Sakolski, *American Railroad Economics*, p. 99.

[2] Interstate Commerce Commission, *Statistics of Railways*. The figure is for 1912, the year when rapid growth of investment ceased.

The road has been noted for its low operating expenses, which absorbed only 50.75 per cent of gross earnings in the banner year of 1916, yet in that year the net earnings from rail operations were only 2.8 per cent on the cost of road and equipment, or less than half the average for the roads of the country. If by reason of the perfection of the plant, operating expenses had been reduced to zero, net earnings would still have been below the average percentage on investment.

This of itself is fairly convincing evidence of overinvestment. The same result is indicated by a priori considerations. Let us suppose that an increased investment in way and structures takes effect by enabling the same locomotives to haul larger trains, and thus increases the possible output, and let us suppose that the stage of diminishing return has not yet been reached (meaning, diminishing return with reference to the proportion of variable to constant factors in this case). The variable factors are chiefly way and structures and cars, and the expenses that go with them in the way of maintenance. The constant factors are locomotives, and the labor involved in "conducting transportation." Coal might be treated as constant, though there would actually be some increase in consumption. The road could then handle 10 per cent more traffic with the same outlay for locomotives and their maintenance, and for "conducting transportation," and a 10 per cent increase in "way and structures" and their maintenance, and in cars. Common sense will testify that this is the most favorable possible assumption, especially as diminishing returns are the normal thing in all industrial combinations of productive forces.[1] Now if the traffic did not increase, the same condition would take effect in enabling the existing traffic to be handled with 10 per cent fewer locomotives and 10 per cent less expense for "conducting transportation."[2] In the case of the Virginian Railway, if the last 10 per cent of the expenditure on way and structures yielded this much service, it was still a losing investment. Taking conditions as they were in 1916, the chief items in the comparison would be an increase of probably about $360,000 in the annual burden for interest and taxes[3] and a saving of $170,214 in conducting transportation, plus a possible trifling saving in maintenance. Thus the gain might be a little more than half the cost, on the most favorable possible assumptions.

The railroad with growing traffic—the typical railroad—is constantly figuring whether its business has or has not reached the point at which it will pay to add something to the "fixed" investment for the sake of a saving in the operating expenses; for example, to cut down the ruling grade, or to lay heavier rails and get more powerful locomotives. They have constantly before them two ways of handling the growth of their traffic. In one the "constant" expenses remain constant and the variable expenses grow with the traffic, and in the other the "constant" expenses grow but the variable expenses per ton mile shrink. At some point in the growth of traffic the cost by the two methods will be equal, and the differential cost of the added traffic will be the same, whichever way it is handled. Thus there are two reasons for increasing the fixed plant; the necessity of added capacity and the opportunity for added economy. Some increases in plant are made *necessary* by growing traffic, others are made profitable, though they may not be necessary.

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[1] The reader is referred to chapter iv above for the background of this bit of argument, remembering that this is a case of "proportion of *adaptable* factors."

[2] This case is not wholly fanciful. The rehabilitation of the Western Maryland from 1913 to 1916 shows an increase of trainload without much change in "conducting transportation" expense per train. Since the plant to start with was dangerously inadequate in spots and badly proportioned, one is justified in assuming that this was an unusually favorable opportunity to make added capital productive. See *Railway Age Gazette*, August 4, 1916, pp. 183 ff.

[3] The writer does not have at hand figures showing how the investment was divided between way and structures, cars and locomotives; hence this figure is to some extent conjectural, but there is no plausible hypothesis that would make it less than $300,000.

To prove the importance of this latter class, one need only remember that, in general, capital per establishment is growing *faster than value of output*, hence the economies of large-scale production are not typically due to the fact that investment costs remain constant, but to the fact that increased investment reduces the "variable costs." In public utilities, cost of plant does not grow nearly as fast as producing capacity, but operating expenses grow still less, so that the *proportion* of investment charges is heavier in the larger plants.[1] All these facts should suffice to prove that no set formula which divides the existing expense accounts into two classes labeled "constant" and "variable" can possibly be an accurate description of the long-run economies of increased business.

4. PHYSICAL ECONOMIES OF LARGE MECHANICAL UNITS

Very small machines are worked by man power, while larger ones use steam, electricity, or some other form of power. Very small power units are too uneconomical to be worth using. The multitude of operations involved in housekeeping are of this small size, and while machinery has long been used to lighten the housewife's labors it was necessarily muscle-power machinery, such as carpet-sweepers, until men learned to develop their power in a huge central electrical plant, and take a little bit of it at a time through a very small motor. A toy steam engine, even a fairly big one, is not worth using even for work that is within its power. The work of feeding it, adjusting it, and controlling it almost duplicates the work that would have to be done for a bigger engine, but only produces a tiny fraction of the power the bigger engine would create.

In fact, the engineer could furnish more power with his own muscles. In the language that we have used before, the labor of tending an engine would be practically a constant expense if we were to increase its size from the proportions of a toy to those of the small-sized engines one sometimes sees at work on pile drivers or construction work. A locomotive needs two men instead of one, plus oilers, wipers, and other specialists in various jobs connected with tending the engine. These latter specialists work about the roundhouse and take care of a considerable number of engines. And so it goes; the ocean steamship employs a small army of stokers, oilers, wipers, and engineers. By this time labor has become a variable expense, in that any increase in size will call for more labor, though perhaps not quite in proportion to the power turned out.

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[1] Paul M. Lincoln, in *Proceedings, American Institute of Electrical Engineers*, 1913, pp. 1937, 1942–43.

Besides economy of labor, there is often a purely mechanical economy in the working of the machine itself. The resistance or elasticity of an iron bar or truss increases faster than its weight.[1] This represents perhaps the chief reason why it is possible to double the capacity of a container or the power of an engine without doubling its weight.

Increasing the size of a mechanical unit, such as a barrel or a firebox or a boiler or a boiler-tube or a plow or the hull of a ship, may or may not bring increased efficiency, although it very often does. Efficiency is a proportion between things you want and things you do not want, and some of these things are bound to increase faster than others, as the working units get bigger. If the shape remains the same as the size increases, some things will increase approximately with the first power of the dimension, some with the square and some with the cube. Surface area, weight, and cubical contents are three typical elements, area varying with the square of the dimension, contents with the cube of it, and weight usually somewhere between, because thickness of wall does not usually need to increase as fast as the other dimensions. There are exceptions, such as the great strength and solidity required in the lower stories of very tall buildings; still in general where the thing you want is cubical contents—and containers constitute an enormous class of mechanical units—there size brings economy.[1] This is especially true where anything is to be kept hot or cold, since radiating surface varies only as the square of the dimension, and the thickness required for insulation does not increase at all, with the result that there is greater economy here than in the strength-giving structure itself. If the height of a building is doubled without increasing the thickness of wall, it will not be as strong, but it will keep out the cold quite as well.

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[1] See Kotany, "A Theory of Profit and Interest," *Quarterly Journal of Economics*, XXXVI, 413, 432-33. This appears to be true, provided the weight does not have to be borne, or the pressure resisted, at an increasing distance from the points of support. Also the limits of elasticity are one thing, and the displacement produced by a given force, within those limits, is another thing and behaves in a different way.

On the other hand, there are such things as radiators, where the whole purpose of a heat-container is reversed, and efficiency lies in giving off as much heat as possible from a given amount of water. The thinner the walls, consistent with strength, the better the heat is given off; the smaller the tubes, the thinner the walls can be and still hold their shape, and the more radiating surface there is per cubic foot of contents. Thus the unit of structure tends to be as small as possible instead of as large as possible, *but* (and here is a saving clause of much import) the machine, or system of units, does not, therefore, have to be small, because it can *muster these small tubes into an army of any size, and use them in connection with other units where size does bring economy.*

For an instance of this general principle we have the tubular boiler, where what is wanted is maximum transfer of heat from fire to water and minimum loss from either to the air outside. Small tubes promote the first end; large aggregates of them promote the second. If a boiler were simply a hollow tank, its contents would increase faster than the radiating surface, but the heating surface would increase no faster. As it is, heating surface and contents both increase faster than radiating surface.

To take another instance, the carrying capacity of a ship increases with the cube of its dimensions, while its resistance in the water increases more nearly as the square, so that it takes less power per ton to push it through the water at the same speed, and it can carry more paying freight per ton of displacement on account of the saving in bulk and weight of engines and fuel. In general, losses by friction and other diversions of energy do not increase as fast as power.[1] Inaccuracies and surface roughnesses in bearings and sliding surfaces become smaller in proportion to the size of the whole. Ball bearings or roller bearings can be more economically used, for the cost of a ball bearing does not increase in proportion to its size.

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[1] This fact is mentioned by Kotany in the article cited above. He makes the principle universal, however, asserting that: "The larger the size of a tool, the smaller its cost per unit of capacity." This is not always true of tools; it depends on the question "capacity for what?" But it would be hard to find anyone habitually using a tool too large to be economical, for obvious reasons, illustrated in the case of the large-size plow.

But—to reiterate—there is no mechanical law which says that efficiency must inevitably grow if the bulk of every tool is blindly multiplied. There is a story of a man who thought of getting the economy of large-scale production in plowing, and built a plow three times as long, three times as wide, and three times as deep as the ordinary plow and harnessed six horses to pull it, instead of two. To his surprise, the plow refused to budge, and to his greater surprise it finally took fifty horses to move the refractory machine. In this case the resistance, which was the thing he did not want, increased faster than the surface area of earth plowed, which was the thing he did want. Furthermore, when he increased his power to overcome this resistance he multiplied the number of his power units instead of their size, which eliminated all chance of saving there, and since his units were horses, the fifty could not pull together as well as two. For there is a waste in numbers which sets limits on the economies of large-scale production, whenever it depends on getting horses, mules, men, or other animals to pull together.

This story is none the less true, even if the incident be wholly fictitious. It does not mean that there is no economy to be had in large-scale plowing, but it does mean that this man made a bad choice of ways to get that economy. If he had multiplied the number of his plowshares instead of the size he would not have increased the resistance out of proportion to the area he plowed, and if he had used a tractor instead of fifty horses, he would not have been bothered by not being able to make them pull together.

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[1] Kotany, *op. cit.*, p. 433.

A gang-plow drawn by a tractor is a practicable bit of labor-saving machinery.

Therefore, though there is no law which says that big mechanical units are invariably more efficient than small ones, there is a law of human choice by which we can select those particular forms of increase in which the thing we want increases faster than the thing we do not want, and reject the others. If we cannot get a gain by increasing the size of one kind of unit, we can merely multiply the number of these units, and generally we will still get a gain through the increased size or fuller utilization of some other unit that works along with them. We can multiply our plowshares and get economy in tractive power, or multiply the lathes in a shop and get economy through a larger central power plant. So long as this increased number of units can be harnessed together mechanically, there will be no difficulty in making them pull together, but if pulling together depends on human organization, we may reach the limit of profitable size through reaching the limit of our own organizing power.

This is the chief limit on size, but it is chiefly a limit on large co-ordinated enterprises rather than on large mechanical units. There are some mechanical features which tend to limit the size of single units—chiefly the fact that repairs, breakdowns, and fluctuations of output can be more economically handled if there are several units, so that all the eggs are not in one basket. Then when one unit is idle the others will work at full capacity and with no loss of efficiency. This means that a plant will often make its boilers, dynamos, vats, or what not, smaller than the most economical size, for the sake of the flexibility that goes witn numbers. In such cases there is a further gain to be had by a plant whose size permits it to have units large enough for maximum efficiency *and enough of them for flexibility besides.* So this fact makes for larger aggregate plants as often as it makes for smaller unit elements.

The economy of multiple units is especially important in "continuous processes" of cooking or other chemical action where the forces of chemistry cannot be hurried nor worked overtime, so that changing the rate of output means stopping the process altogether and starting it again. That is frequently a very expensive thing to do, especially in the case of a blast furnace. *It is far more efficient to work four furnaces steadily than six furnaces two-thirds of the time.*

Another fact which sometimes limits size is the difficulty of exerting force over increasing distances. The telephone is a special case in which the number of possible connections to be provided for increases faster than the number of subscribers. In general, however, mechanical units reach their limit of size not because larger size would increase costs so much as because it would not decrease them materially, while flexibility would be sacrificed by having one unwieldy mammoth rather than more units of smaller size.

5. UNUSED CAPACITY OF PARTS OF A COMPLEX PLANT

It is seldom or never that every part of a plant is developing all the output that is reasonably in its power, even when the plant as a whole is "working to capacity."[1] An unloading plant may have two bridges in order to insure against breakdown, though the work does not tax the capacity of one. The patterns of a foundry play largely a waiting rôle. In a small shop a lathe would be idle most of the time. A larger shop might keep the same lathe busier without needing another, though it would need more equipment of most kinds. By the time a large lathe is working to capacity there may be a crane bringing it its raw material and this may be idle a large part of the time. And so on indefinitely. The main line of a railroad seems practically always to have unused capacity, the limiting factors being the rolling stock and the ability of the terminals to feed cars on to the line with regularity and take them off the line and dispose of them promptly at their destination. Thus there are practically always some points of congestion in a plant, and other parts that do not need to be increased in order to handle additional business.

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[1] This does not refer to the "law of diminishing return," whereby some factors *must* work at relatively low efficiency if the complementary factors are to accomplish their utmost. It refers rather to the "minimum dose," before diminishing return sets in. The examples in the text indicate the kind of cases referred to.

This represents unused capacity, and in general the larger the plant the smaller the percentage of this sort of waste is likely to be. This is not always true, however, where the smaller plant grows in a patchwork fashion. If the smaller plant was carefully designed for just the volume of business it was capable of handling, growth may increase the waste rather than diminish it. Thus Mr. H. H. Titsworth takes the position that a balanced plant should not be unbalanced by piecemeal expansion, but that expansion should wait until another balanced plant unit can be added, and Mr. H. T. Noyes emphasizes the care necessary in planning a plant so as to make expansion possible.[1]

6. KNOWLEDGE AS AN OVERHEAD COST

There is another sort of productive machinery that is not often spoken of in the same breath with lathes or freight-cars but which has to go along with them if they are to be live industrial capital instead of worthless junk. This other productive instrument consists of knowledge, information, and the results of all forms of industrial experimentation and research. Here we have an expense that comes nearer being genuinely constant than any other, in the sense of being independent of output.

The reason why other "constant" expenses all vary is that the machines, or buildings, or material equipment of any other sort, on which the so-called "constant" outlays are made, can, after all, do only a limited amount of work and can be used up. Two trains cannot run in opposite directions on the same track at the same time and there is a limit to the number of trains which can run in the same direction on the same track in one day, while the rails wear out more or less in proportion to the number of trains passing over them, and the ballast has to be renewed more or less in proportion to the pounding of the traffic. But the knowledge of how to temper the rails, how to prevent transverse fissures, how best to treat the ties and how to anchor the rails and ties together, how to prevent accidents, organize train schedules, and keep the necessary accounts and records—this knowledge is not worn out or exhausted no matter how much use is made

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[1] *Annals*, LXXXV, 63–65, 68.

of it. It is only the material means: the labor, the steel, the wood, and the chemicals, that may be used up in the process of exploiting this knowledge.

In a sense, knowledge is the only instrument of production that is not subject to diminishing returns. This means that an added output brings possibilities of economy in all those items of expenses that come under the headings of knowledge, information, and research. The same research department can serve a large plant about as well as a small one. Indeed, in technical matters where a law, once learned, is universal, one laboratory could serve the entire business of the country or of the world without any added expense so far as the mere getting of the results is concerned except to allow for local differences in materials. Also the service of communication would cost something and the results might not be useful in countries where the market requires different goods, or where different customs of workmanship or a local scarcity of capital make standardized mechanical methods impossible. Thus there might be limits on the value of the results, but there can be little question that knowledge is useful in proportion as it is widely distributed, and that there is a distinct loss in keeping any useful bit of general technical information as the exclusive property of a single producer and yielding its results in the way of more economical production only to the limited output of a single establishment.

The costs of intellectual equipment, then, are one of the big sources of economy in large-scale production. This applies not merely to chemical and mechanical research and inventions, but to the trade information gained by the management through various channels of its own, including its own selling force. It applies to the working out of any standardized system of doing things: for arranging machines on the floor of a shop, or show cases and stocks in a retail store, for the work of accounting, or for advertising and selling campaigns. The advantage of large-scale production in these matters sometimes becomes so important that a new branch of production is established, specializing in these particular services and selling them to a large number of business men. Specialists in advertising and in scientific management are examples of this sort of thing in private business, while the Harvard Bureau of Business Research has been working out standard systems of retail accounting, and the Federal Bureau of Mines and the Federal and State Departments of Agriculture have been contributing to industrial research from the side of government.

This movement is extremely interesting and extremely significant. It works in the direction of making small-scale production or moderate-scale production more efficient than before by giving it the advantage of a centralized service in those departments where small-scale production is most peculiarly wasteful. If something of this sort is not somehow accomplished, scientific knowledge gives the large-scale producer an advantage which the progress of science is continually increasing. Scientific management means one more step in this process, because it puts at a discount the ordinary traditional skill of the laborer (a form of industrial knowledge that the small-scale producer could get on equal terms with the large) and puts in its place standardized methods resulting from scientific experimenting, time studies, and the work of a "planning department." It has taken the trade knowledge of the laborers, which used to be practically free to any employer, and overmatched it by the aid of these expensive standardizing studies which become virtually a part of the employer's capital, yielding greater economies in proportion as they are used on a large scale.

The ordinary work of buying and selling shows economies that really belong in this class of better utilization of knowledge. An order to buy goods is a matter of communication and it costs no more to send in a big order than a little one. This saving is not merely a question of stationery and stenographer's hire but of the time spent in getting together data to make the judgments whether it is wise to buy goods at such a time and at such a price or not.

While size clearly brings a gain in utilization of knowledge, there are two ways in which it can be taken and the business man generally chooses, perhaps more or less unconsciously, to take a little of both. He could, if he chose, spend no more on information than he did before and get larger returns, so that the cost per unit of output would be lessened. Or he could spend as much per unit of output as he did before and get far more perfect information. In practice, he generally compromises between these two policies and gets some gain of each sort, with no way of measuring accurately the point of greatest efficiency. From the community standpoint, it is probably best if the manager gives the benefit of the doubt to increased research, but that is a doubtful gain for humanity unless our knowledge of human needs and human relations keeps pace with the changes which purely technical inventions bring about.

In the past, industrial research has been dangerously one-sided. It has promoted technical "progress" which has resulted in profoundly altering the effects of industry on the mind and life of the worker, and the human relations involved As a result, old habits and customs in these realms have lost their value, and a bewildered groping has taken their place, which is strikingly in contrast with the incisive certainty shown in the mechanical field. A form of social wealth of the intangible sort has largely lost its value: society's intellectual overhead has suffered serious obsolescence from the very growth in effectiveness of the intellectual overhead embodied in industrial research. Some method of restoring a balance is necessary, not merely to social welfare but to the continued effectiveness of industry. Innovation in the technical and business sphere calls for adaptation in the human sphere, and unless the two maintain a fair balance, the results are necessarily painful.

The economies in the use of knowledge are largely responsible for the savings that come with buying and selling goods in large quantities, and for some of the advantages that appear in the raising of capital. This fact of large-scale buying and selling is often spoken of as one of the explanations of the economies of large-scale production. But of course it does not explain the economies of size merely to say that they happen in this department. The advantage that the big concern gets may be merely an unfair advantage in bargaining power and not a true economy at all, but so far as it is a true economy and rests on being able to do the necessary productive work more efficiently, it depends very largely on economical use of market knowledge, and the time and trouble it takes to acquire it. In much the same way the personnel department and the legal department show economies in the imponderable factors of production. All in all, this is one of the important classes of economies, and one where the decisive advantages of the large concern can be tempered by organizing effective industrial research on a co-operative or a public basis. This is something that must be done, and done well, if healthy competition is to be preserved.

7. FURTHER DIVISION OF LABOR

Even large concerns could introduce more specialization of labor, if they were still larger. Acworth tells how the North Western Railway employed two men solely to make artificial limbs, and the Midland kept eight cats to catch the rats that tore the sacks in its warehouses.[1] Where the business is already fairly large, gains of this kind, in the actual work of production, are mostly either of moderate amount or else have to do with secondary sorts of service. These the factory is not usually obliged to produce without its own walls. The North Western Railway could have bought artificial limbs from some concern which produced them on a larger scale than two men were capable of, though the railroad's two specialists probably turned out a more individualized product, and one better adapted to the special needs of railroad workers.

In general, it is in the work of direction, rather than in the physical work of production, that the largest gains from subdivision of labor come after fairly large size has already been reached. There are two main kinds of division of labor in management, cutting across each other. One separates the forming of policies, rules, and precedents from the gathering of data on which the decision is based, and from the following out of these policies and precedents in particular cases, and the other separates different departments of work such as purchasing, selling, engineering, financing, etc. One brings the economies of delegated detail and routine, the other the economies of functional specialization. Each has its advantages; each can render notable services, and each has the defects of its qualities.

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[1] W. M. Acworth, *The English Railways*. Cited by Edgeworth, *Econ. Jour.*, XXI, 347.

The economies of delegated detail increase the capacity of the manager, and of the overhead expense he represents. They enable more output to benefit by a given decision, and the study or experience that went into the making of the decision, and by this means they also make it possible and profitable to put longer and more intensive study into the making of each decision. In fact, what has been said already about knowledge as an overhead cost applies to the making of decisions and precedents, those intangible productive instruments which it is the supreme task of management to furnish. If the managing staff of a large-scale plant were made up of the same men who would be managers under small-scale production, with the difference that the best mind made the most basic decisions and the others executed or applied them, there would be a considerable increase in the efficiency of management, but no reduction in the cost, in terms of the percentage of effort spent on management. The tendency is, however, to go farther and delegate the more routine tasks to people who would not be managers at all under small-scale production, sometimes to people who are not of the manager type, but are even better at gathering data or at carrying out policies they were not responsible for forming.

This may degenerate into exploiting cheap labor and intrusting routine managerial work to those who are incompetent to understand the "why" of what they are doing, and hence unable properly to discriminate between case and case, and to handle the exceptions that are always arising. An intelligent and responsible subordinate may receive orders drafted by one who is really his inferior, following a prescribed formula, and the subordinate has some provocation for feeling that he is dealing with a rigid, rule-enforcing machine rather than with a human being possessed of judgment and discretion, on whom the reason of his case might make some impression. Things become matters of routine which should not be thus petrified; emergencies are at the mercy of routineers; and there is danger of developing the attitude which avoids assuming responsibility and spends much of its time and energy in "passing the buck," or in staving off the efforts of others to pass it.

The finest fruit of this is the bureaucrat whose chief ambition is to become a safe channel for passing reports upward and instructions downward, unmodified by any act of his. Of the same school was the district freight agent (or the clerk in his office) who received an inquiry as to whether a mixed carload of specified goods came in a certain rate group, and in return referred the local agent to the same tariff through which he and the shipper had already searched in vain. After some correspondence he hazarded an *opinion* that the higher rate prevailed, but the local agent gave the shipper the benefit of the lower grouping, and the shipper was left wondering whether "a ferreting auditor may drag the item from a mildewed file and an outraged law department may come roaring after me for the difference involved, a matter of $1.60 per ton on the entire carload."[1] This is an example of the working of that system of "checks and balances" which is partly the direct result of size, but largely also of the public regulation (a further "check and balance") which size carries with it when it reaches the stage of monopoly power.

Tendencies in this general direction are nowadays both insidious and powerful. Therefore, if the savings from delegating managerial detail involve delegating no managerial discretion and demanding none of the managerial type of initiative on the part of the subordinate, they are a danger rather than a source of strength. If "economizing managerial ability" means getting on with a smaller percentage of it than before, it is well-nigh suicidal in the long run.

The concern may "economize" in that way, if it is willing to take the consequences, but can industry as a whole do so? This would mean either developing less than before of that grade of ability which can make decisions, or not using all that is developed, which would come to the same in the end. Either one would be equally preposterous as a goal toward which to direct a conscious social policy. Society cannot save by employing less of this grade of ability, but rather by developing more. And whatever is unavoidably necessary for society is good industrial policy. Management cannot afford to intrust executive work to those lacking executive ability, nor to delegate it in a way which deprives the managerial agent of all executive discretion and responsibility.

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[1] Winthrop Martin, "A Shipper Comments on Railroad Morale," *Railway Age*, LXXIII, 929.

As for departmental specialization, the advantages are obvious. The chief disadvantage probably lies in the fact that a department comes to have goals of its own, records of expansion and workmanlike achievement, which may not adequately measure their net contribution to the success of the whole enterprise. Witness the conflict between selling department and production department over the undue multiplication of sizes and models. These are merely suggestions, since a thorough study of managerial specialization would carry us too far afield. One of its chief advantages consists in fuller utilization of knowledge, and this has already been discussed.

8. REDUCTION OF RISKS BY CONSOLIDATION

It is a commonplace that uncertainty becomes less for a large group than it is for any of the members of the group.[1] One man may or may not die; one house may or may not burn; but a thousand men or a thousand houses behave in a predictable way. One aspect of this has been given a special name by the public utility engineers. It is uncertain just when one consumer will use his power, but there is considerably less uncertainty as to the distribution of demand from a large group of similar consumers. This depends on the fact that their greatest individual demands do not all come at the same time and this is what the public utility people speak of as the "diversity factor."[2]

This advantage of size appears in almost every department of a business. The large company can carry its own insurance in some cases. Its repair forces may work more steadily, and so may other kinds of indirect labor, while its orders for goods are likely to come in with greater regularity. Two or three customers with large orders will not make such a great impression on the total volume of business. Stocks of goods can be smaller compared to volume of trade.

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[1] This is mentioned by Marshall and Lyon, *Our Economic Organization*, pp. 256–58.

[2] The technical measure of this is the ratio between the maximum demand of an entire group and the sum of the individual maximums.

After the main business has already made the largest gains in the matter of stability, side-lines and by-products may still be on an unstable footing owing to small size, and may have much to gain from further growth. This greater regularity is an advantage both in buying and in selling. It does not exempt the company from the ups and downs of the business cycle, but it frequently helps them through minor crises or seasonal depressions in particular branches of their business, if they have numerous other branches not subject to the same disturbance or having a different seasonal rhythm. All these elements of lower cost and risk react also on the company's financing, making it easier for them to raise funds on reasonable terms. Another element which may or may not strictly belong under this heading is the fact that the large concern is somewhat less liable to have its processes made obsolete by some competitor.

9. ECONOMIES IN BUYING

The savings in buying may roughly be divided into two kinds: savings resting on economies in productive efficiency, and advantages in bargaining power pure and simple, although the two are intimately related to each other. As we have seen, buying on a large scale economizes all the work involved in studying the market and investigating the qualities of the goods, as well as the routine work of putting in orders and filling them. It is both cheaper for the purchaser to give large orders and for the seller to receive them and fill them, and the purchaser may get the benefit of this in the shape of a lower price. And the large buyer commonly knows the markets better and the goods better.

On the other hand, a large purchaser may get more than this in the way of bargaining advantage. Just what bargaining advantage consists of is not always easy to say; part of it undoubtedly consists of favoritism and prestige and part of "bluff." Apart from this, however, the advantage of size rests largely on the fact that it is simply not possible for the large concern to burden responsible officials with the work of quoting special prices for every little consumer. Some small consumers might know the market as well as large consumers do and might be in a position to buy from a rival at a favorable price. They might have all these strategic advantages that a large customer could possibly have—only the concern will not quote a special price for them. They can realize on their bargaining advantages only by going elsewhere. The concern will lose one customer, but it will be getting the benefit of the law of averages on the small customers as a class. If they treat them all alike, they will lose only a small percentage of their total trade, because most of the small customers are not intimately in touch with the market. On the other hand, when a large customer comes with the same weapons in his hands, the concern will think of him as an individual, not as a unit in a problem of averages, and will be more likely to figure as close to their differential costs as may be necessary, in order to secure his business.

One way of putting it is to say that a large order will repay the cost of a separate decision as to price policy, while the same cost would be prohibitive for each one of a lot of small orders. But if the concern cuts the price to an entire class of customers in order to hold 10 per cent of them, it will sacrifice part of its earnings from the other 90 per cent. On the other hand, when the large customer comes and they lower their price to hold his business, they need not lower any one else's price at the same time. He becomes a class by himself and the whole of him is at stake in the bargain that may be struck.

Other advantages come in the shape of service. People will take more trouble for the large customer, and they may take more trouble over one order than it is worth, if there are other orders in prospect.

10. ECONOMIES IN SELLING

It is difficult to figure whether large-scale production has, on the whole, increased or decreased the costs of finding a market.

There is little doubt, however, that it has made them a larger percentage of the whole, because it has reduced the bare cost of manufacture in such a revolutionary way. For this purpose costs of transportation are properly counted as part of the total burden involved in reaching a market. The modern large factory, selling over a nation-wide market, must not merely produce goods cheaper than the small local establishment, but enough cheaper to pay the freight rates and other transportation costs on its products, its raw materials, its implements, and many of its structures and often on the goods which its employees consume, and something for the cost involved in carrying its employees to and from their work, including the lost time of the employees themselves. Manufacturing concentrated in large cities is accountable for all these burdens of transportation, which add up to a surprisingly large amount.

The ordinary superficial view of this problem is quite misleading, for it looks no farther than the freight rates paid on the finished product, and when it finds that these are so low as to be almost negligible it concludes that transportation need hardly be considered as a burden. Needless to say, this is quite beside the mark. The total bill for freight (inland water and rail), express, and parcel-post carriage alone is not far from 10 per cent of the total national product. If the costs of carriage and distribution for which large-scale manufacturing is responsible could be accurately determined and compared with the value produced by large-scale manufactures, the percentage would be far larger. It is quite probable that the accessory burdens of carriage and distribution would exceed the bare manufacturing cost, in these large-scale industries, but not without imputing some controversial items, for which responsibility could only be inferred and not definitely traced. Granting, however, that the cost of distribution could be made to look this large, this would not necessarily condemn concentrated manufacturing, but merely serve to point out how its economies are not clear gain, but have to bear the burden of the expenses outside the shop.

Aside from transportation, marketing over a great distance involves other elements of increased costs. Salesmen's traveling expenses are heavier, time is lost in correspondence, and local peculiarities are likely to be less perfectly provided for. Dealers far from the source of supplies must keep larger stocks, since they cannot replenish them as quickly in case of sudden need. All these are penalties of distance. On the other hand, granted that a business is already marketing over a given area, increased size by way of more "intensive cultivation" of the market brings some important elements of economy.[1] Carload rates furnish a concrete instance, while the actual work of organizing and carrying on a large-scale selling campaign affords some general savings. Planning the campaign is itself an overhead outlay and the minor tactics of the individual salesman have something of the same element in them—often they are learned in a company school for salesmen. Moreover, once a wide market is gained it usually returns a steadier business under the law of averages. A salesman can commonly handle a variety of related goods more economically than one specialty. It helps him to have a "good line." If a plant is to furnish him with a varied output to sell, and still produce enough of each type of commodity to secure maximum efficiency, it must be a very large plant indeed.

Besides the physical question of productive efficiency, there are strategic advantages of bargaining position and competitive maneuvering, which play a more significant part in the act of selling than anywhere else, even in buying. A wide market gives opportunities for meeting local competition while keeping prices up in other localities, or for concentrating selling efforts where they may be most needed at the moment. It undoubtedly widens the margin within which the concern can choose its own selling policy, making the compulsions of competition less insistent. One symptom of this is the fact that the average amount of unemployment in dull times is far greater for large businesses than for small.[2] While this is presumably the result of many forces, it is safe to conclude that one cause is the greater freedom the large concern feels to take the lead in maintaining prices, while the smaller business is driven to maintain production at whatever prices the market makes possible. This testifies to the power of the large concern more than to the wisdom with which it is exercised.

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[1] For this distinction between covering a wider field and more intensive covering of the existing field, see L. D. H. Weld, *American Economic Review Supplement*, March, 1923.

[2] See W. I. King, *Employment, Hours and Earnings*, pp. 30–34. Referred to by W. C. Mitchell, *American Economic Review Supplement*, March, 1923.

11. ADVANTAGES IN FINANCING

"To him that hath shall be given" is nowhere truer than in the financial field, where the better established the success of the concern, the lower interest charges it can command, reflecting the safety which the investment derives from all the advantages that have been discussed above.[1] Besides which it is undoubtedly true that the commodities a concern sells advertise its securities. Conservative people are more ready to invest in a concern they already know as a large and presumably a successful one than in some business of which they had never heard before they were invited to buy its securities. Furthermore, there is a genuine advantage in being able to find a market quotation on the financial page of any newspaper. The net result of all these advantages is to create a something else, compounded of them all and yet psychologically distinct; something more than the mere sum of its constituents. This something is called "prestige." It is one of the most subtle forms of intangible capital, and one of the important advantages of size.

And here we may bring to an end this story of the advantages of size, not because the subject is exhausted, but because if we went farther we should be carried beyond the limited field of introductory generalization and into the limitless realm of particular cases. It remains to notice a few of the factors that work in the other direction.

12. DISADVANTAGES OF SIZE

The chief disadvantages of large size are summed up in complexity of organization, impersonal relations, divided responsibility, the multiplication of "checks and balances," and the undermining of initiative and spontaneous interest in the success of the business. All these handicaps are matters which vary a great deal with the character of the work. They are intensified where the size of the business results in its being put under special government control, and it is worth noting that they are all substantially the same weaknesses which handicap government operation as compared to old-fashioned "private enterprise." In fact, large-scale production under modern conditions is rapidly narrowing the gap that separates private from public management.

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[1] See Kotany, "A Theory of Profits and Interest," *Quarterly Journal of Economics*, XXXVI, 413, 452.

To take a sample illustration of the way in which these limitations work, farming is a kind of production in which either the worker must be vitally interested in the success of the undertaking or else must be constantly in touch with some boss who is vitally interested. He is not like a machine worker on a piece rate or on a job where the machine does its own driving. His work is varied and unstandardized and conditions differ so much that it is almost impossible to set a rigid task and hold a man to it without elastic personal supervision. Probably this is why the expansion of farm units by taking on large amounts of hired labor seems to bring decreasing efficiency rather quickly, except in cases where large areas of level land of fairly uniform quality are cultivated with one crop, using machinery on a large scale. Modern methods of fruit-growing also involve considerable amounts of equipment and standardized operations, especially spraying. Here larger units appear to work well. In varied farming, however, the one-family farm appears to hold its own.

The loosening of the ties that bind the organization together sometimes goes so far as to produce actual conflicts of interest and hostility. The company becomes an impersonal thing and the members and employees can steal from it without feeling that they are stealing from persons to whom they owe loyalty. This is largely the result of the corporate form of organization, but it increases with size and affects every class, from the board of directors down to the lowest-paid manual laborer. In the case of labor, the large organization makes it harder to overcome the jealousy and suspicion and class hostility which lead laborers to feel that the employer is their natural enemy; that he does not give the laborers what they are worth, and that it is the manly thing not to give him in return the best service of which they are capable. This disadvantage can perhaps be partly overcome by a really efficient personnel department, such as only a large concern could easily afford, but at present it cannot be said that the typical concern has demonstrated in its actions a belief that it can afford a really efficient personnel department. Many have dropped their personnel work when hard times made labor tractable,[1] and others seem to have lacked the fortitude to keep a superior man in this department after he had proved his worth. But perhaps this whole class of work is in too transitional a stage to justify predictions as to what size of concern will turn out, in the long run, to have the greatest advantages in this field.

Being a member of an impersonal organization does not always injure the loyalty and effectiveness of a worker. At its best, the "traditions of the service" may establish a sort of personality behind the worker, mythical yet very real, which holds him up to his best performance and gives him the confidence and sense of support which serve to overcome the material discouragements of the lonely worker. In order to have this power for good, the service must itself have a character which can inspire loyalty by being worthy of loyalty. Modern business in its typical character as money-making does not easily inspire this kind of loyalty, except to some extent among the salaried employees. If it does actually succeed in establishing a real *esprit de corps*, it must be on account of the particular character of the particular business, and in the last analysis it must rest on some large and strong personality. The larger the business, the harder for this personality to make itself felt through the mechanism of orders and reports which are its ordinary means of communication. The morale of a service is a force which derives partly from the existing organization, but even more largely from its past. In fact, it is more a function of time than of mass, and quality counts far more than quantity. The business which would build up this intangible asset cannot afford to strive solely or chiefly for quantitative expansion.

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[1] See Douglas, "Personnel Problems and the Business Cycle," *Administration*, July, 1922, pp. 15-24, especially pp. 21, 23, 24.

Another phase of growth in size which may bring some disadvantage appears when the growth is of the piecemeal sort and has not been adequately planned for in advance. In such cases, as we have seen, it may pay a concern not to try for expansion unless it can be fairly sure of finding a market for the product of an entirely new unit.[1] However, this sort of self-denial is a counsel of perfection and not likely often to be followed. Another way of meeting this difficulty consists of building a plant larger than the present demand requires, and accepting the handicap of working at a lower percentage of full capacity rather than the handicap of too frequent rebuildings and expansions. But this dose not mean that it is necessary either to wait until the market doubles in size before expanding or to build a plant twice the size required for the present output. A plant can be planned with reference to piecemeal expansion, generally at little extra cost, so that construction for a conjectural demand in the distant future is not economically necessary. Thus a concern need not build far ahead nor incur heavy additional expenses on this account.

[1] See p. 119, above.

CHAPTER VII

ECONOMIES OF COMBINATION

SUMMARY

The need of making distinctions, 135—Integration, 136—Horizontal combination, 141—Freedom from competition, 142—Conclusion, 146.

1. THE NEED OF MAKING DISTINCTIONS

In dealing with this question it is necessary to distinguish at least three elements: vertical combination or integration, horizontal combination, and freedom from competition.[1] Though in practice these are combined and interrelated, it is essential to conceive them as separate facts, if only for the purpose of studying their interrelations. If we ask, for instance, whether integration makes monoply inevitable, the first step is to study integration as a separate fact. In all these forms of combination the motives at work include a great deal more than the productive economies that are expected to result, while the expected economies are often viewed in a distorted focus.

The motives could roughly be analyzed into five groups. First come the profits of promotion, fortified by the "bias of happy exercise" on the part of men with a gift in that direction. Second, perhaps, comes the urge for increased power and wider areas of control, an urge which is so general and so strong that it seems fair to call it an end in itself. Third comes monoply advantage, complete or partial, or the extension of the range and effect of monopoly advantages already possessed. Fourth comes a reduction in the effectiveness of competing producers, which may be brought about either by absorbing the most efficient or by limiting the access of outsiders to materials, processes, or marketing facilities. To some extent this overlaps the gains of monopoly advantage, and to some extent it represents the negative or "invidious" side of the fifth and last class of motives to combination: namely, gains in productive efficiency.

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[1] Vertical combination means the combination under one management of successive stages in a chain of productive operations, such as mining, transporting, smelting, and rolling out rails. Horizontal combination means the combining of a number of separate enterprises in the same stage of production, such as a merger of sugar refineries. This does not refer to agreements limiting competition between independent concerns. Horizontal combination *per se* need not have monopoly either as its primary purpose or its inevitable result.

These last are important, but not necessarily decisive by their own unaided force. They have more effect on the long-run success of combinations than on the original impulse to form them; they are a test of the fitness of combinations to survive far more than an explanation of their coming into being. In the earlier stages of a combination, the expected economies furnish "talking points" for the promoter, anxious to market his securities and realize his organizer's profits, and pretexts or "rationalizations" for the hope of monopoly advantages or the urge of expansion and broadened control.

From the standpoint of overhead costs it is the productive economies that are of interest, and from this point of view the preceding discussion is a digression. It is worth while, however, in order to avoid the misleading implications that would result from studying combination in terms of productive efficiency alone.

2. INTEGRATION

Integration is commonly thought of as a way of getting two profits instead of one or of getting one's materials "at cost." This is, of course, true in that a business man expects to make more than the current rate of interest whenever he engages in a business for himself (even though this expectation may be frequently disappointed); and so he would naturally expect an outside venture to increase his profits. But this does not explain why he goes into the particular business of producing his own raw materials and tries to absorb that particular profit instead of doing what men of large property frequently do, invest in wholly unrelated industries. Perhaps he has a special feeling of dislike at having anybody else making a profit out of his own purchases. That is a natural sentiment, perhaps, but hardly an economic argument. It still does not explain why he should expect to profit more by doing his own carrying or mining or marketing than by going into some other outside venture.

Perhaps he expects to succeed because his knowledge of his own business will help him to produce just the kinds of material which that business needs to use. Here we have a genuine economic argument—and also we have discovered an element of overhead cost. The employer's knowledge of his own needs and of the conditions of his own business is an expensive industrial asset, and it can serve two purposes, contributing something to the needs of two businesses. In this sense integration is really a case of joint costs. This is perhaps a part, though not all, of the elemental truth expressed in Franklin's proverb: "If you want a thing well done, do it yourself." The other part is largely faithfulness: the servant not only understands completely the desires of the served but the sincerity of his service is beyond question. Both points are weakened where servant and served are huge corporations, acting via their hired employees; nevertheless, both arguments still contain a deal of verity and force.

Consequently another gain from integration arises, in the shape of great reliability in the supplying of materials. The two concerns adapt their processes to each other, and the supply of materials, both in quality and regularity, can be more carefully suited to the needs of the user than they would be if the two were independent concerns, no matter how genuinely the maker of the materials might be trying to look out for the interests of his customers. His attention would normally be scattered between a number of different purchasers and not wholly focused on the needs of one. Another thing that is saved is all the work of negotiation, bargaining, higgling, stimulating demand (on the part of the seller) testing qualities (on the part of the buyer), and much of the other work of buying and selling, which could be reduced to a matter of routine. Here we have an overhead outlay which is capable of being enormously reduced by vertical combination.

Where a company makes its own equipment there is an opportunity to base policies of renewals, and especially the adoption of radically new types of machinery, on a truer reckoning of cost, because the constant costs of the equipment department can be treated as constant costs and are not converted into variable charges, as they are when the maker of equipment is independent and must cover his overhead out of the price he charges. If this opportunity is taken advantage of, it ought to have two results. Renewals and extensions should be scheduled with a view to regularizing the work, and minimizing idle overhead in the equipment department, rather than concentrating the work as is typically the case where the producer-customer has no responsibility for the overhead costs of the machine makers.

And when some new type of equipment would call for new and specialized instruments to make it, an integrated concern should consider the policy as a whole, waiting until it is fairly sure that the machines-to-make-the-machines will be wanted long enough to justify them. This means looking a generation ahead. Then, having once made the decision, they would be slow to change, since they could continue without added overhead burdens, while change would involve a new overhead investment. The non-integrated concern does not assume these risks but imposes them on the maker of machinery, and, therefore, has no adequate incentive to reduce them—wherefore it pays high, in the long run. This last point should not be overemphasized, since much of the metal-working equipment used in making machines is quite adaptable. In some cases, however, a change in the product calls for large investments in new equipment. The regularizing of renewals and extensions is nevertheless an ever-present need and one of very great importance.

Integration may reach backward or forward, absorbing either the process of producing raw materials or the selling of the finished product, or both. Where it includes marketing, one of the most important gains lies in the fact that the dealer has so much more complete harmony of interest with the producer of the goods he is selling that he can be counted on to take proper care of them and to do them justice in the eye of the customer. It is said that one of the most important forces impelling the meat packers to take up marketing is the fact that independent dealers do not take good enough care to preserve perishable products.[1] Where goods have a specialty character, and have been much advertised, the manufacturer is often impelled into the marketing of them, in order to be sure they receive fair treatment and are competently pushed.[2]

Certain enabling conditions must be present. Sales must be large enough so that the concern's interest in any locality will warrant establishing an agency there. Preferably, the manufacturer himself should furnish a "full line" similar to the assortment of the ordinary dealer, but this is not absolutely necessary. Integration in marketing may either start with the manufacturer who reaches out into the field of distribution, or with the mercantile establishment which establishes its own factories. In either case the concern must have grown to very considerable size to make the extension worth while. Granted a large distributing agency, the gains from integrating it with factories are at bottom the same as when the process starts with the manufacturer. Even the moral element is there, since the dealer can now be surer of the quality of the goods he is pushing.

Consumers' co-operatives are a special case, for they often find difficulty in securing fair treatment from the existing regular dealers, who are interested in protecting their traditional place in the trade. The co-operative store is sometimes classed as a "consumer," and so is unable to buy goods at wholesale prices: sometimes more indirect tactics are resorted to. It appears, in fact, that retailers, wholesalers, and manufacturers generally follow a "live and let live" system with regard to each other, and protect each other's interests against outsiders who are regarded as interlopers because they threaten the conventional system of middlemen. This jealous attitude suggests a suspicion that possibly there are some customary margins of profit which could not easily stand the test of competition with more direct methods of selling: in fact, that there may be something like monopoly gains in some parts of the process, gains which an integrated concern could absorb into its own treasury. To the extent that this may be true, it justifies the man in the street in looking upon integration as a method of making two profits in place of one, or of saving the dealer's profit on the goods. Such gains are unquestionably exaggerated in common report; nevertheless, one would be credulous who assumed that they had no existence at all.

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[1] L. D. H. Weld, *American Economic Review*, March, 1921, p. 93.

[2] On this whole subject see Haney, "Integration in Marketing," *American Economic Review*, September, 1920, pp. 528–45.

Integration has a connection with monopoly somewhat like the connection between joint-cost and large-scale production. Wherever one of a series of processes is in the hands of large combinations or of a monopoly, integration tends to spread this combination or monopoly through the other steps in the series. If one process is naturally monopolistic, the others tend to become so, if those who control the monopoly wish it. A monopoly in one stage can be used as a fulcrum from which to topple over competition in the other stages. Or, to change the figure, the chain of competition tends to be only as strong as its weakest link. The greater the advantages of integration, the harder to keep competition alive.

Not all the forces are working in the direction of integration, however. Over against the maxim: "Do it yourself," stands another, sponsored by economists from Adam Smith down. Its modern form is: "If you want a thing cheaply done, hire a specialist who does that thing for half the world and on a mammoth scale." This is the chief reason why any concern ever buys materials and equipment from other concerns and lets them make profits on the production and sale of these things. If my business takes but a small part of my neighbor's product, he can probably do the thing more cheaply than I could, working as I must on a smaller scale. But may he not turn the argument around and make a gain by absorbing me? Sometimes, but not if his process is a minor or incidental one in my business. Thus we have the makers of parts for "assembled" automobiles, the advertising agency, the consulting engineer or efficiency expert, and the public accountant: functional specialists all of them, working on a large scale and more effectively than they could if confined to the service of one concern. Such specialists are really the saviors of competition, for they give the concern of moderate size the benefit of services produced on a large scale, which the moderate-sized concern could not perform for itself without prohibitive cost. Without such possibilities, only huge consolidations could be efficient.

It is significant that the examples are all but one concerned with some form or other of knowledge; the industrial instrument with unlimited capacity, which shows increasing economy with increasing utilization, and never reaches the stage of "diminishing return." To be efficient, the enterprise of extending the frontiers of industrial and economic knowledge must be carried out on a large scale; yet the results must also be made available for the benefit of smaller scale producers, unless we are to submit to a ruinous waste of overhead in this respect. If industrial research becomes the sole perquisite of the concern which can afford an expensive laboratory, there is an end of economic freedom, and as a long-run result, perhaps, an end of economic efficiency, owing to bureaucratic stagnation.

Even in the realm of knowledge there is a limit to the economy of size and combination. Research and publicity are best promoted, not by one all-powerful consolidation, free from all the checks and stimuli of healthy rivalry, but by a moderate number of strong organizations, able and ready to test each other's work and to do it over again if necessary. Where results need verifying, repetition is not real duplication, and is far from being a waste.

3. HORIZONTAL COMBINATION

A large part of the savings of horizontal combination are simply continuations of those that come with growth of single plants. While the fundamental mechanical gains, and gains from subdivision of manual labor, are mostly confined within the walls of the plant, all the other sources of economy continue to yield some gains when plants in the same stage of production are combined with each other. Chief of these are the economies in the work of management, research, and information—the intellectual overhead costs. Similarly, the economies of buying, selling, and financing continue—the last possibly strengthened by diminishing the menace of competition. As for the consolidating of risks, plants in different regions afford an obvious advantage in meeting local troubles of all sorts, from weather to labor disturbances. There is some possibility of further savings in connection with by-products, though this would be far easier if the whole output were within the inclosure of one plant.

Beside these, there are some gains peculiar to horizontal combination. The saving of cross-freights and the specializing of plants[1] are always mentioned in this connection, though generally without calling attention to the fact that the same combination cannot get both savings at once, and that to the extent that it gets one it must sacrifice the other. Another gain, already mentioned in another connection,[2] comes from concentrating fluctuations in a single plant. This involves some sacrifice of both the other economies, since the plant which carries the fluctuations must turn out a full line of goods and must sometimes ship to territory naturally tributary to other plants.

There is also a chance, where plants are not so specialized as to differentiate them too much from each other, to compare records of efficiency between plants, and so to introduce the stimulus of rivalry without the drawbacks which result where each competitor keeps his methods to himself. This substitute for competition may have large future possibilities, but so far as it has yet been developed, it is doubtful whether it more than neutralizes the various elements of unwieldiness in an organization spread over such distances.

4. FREEDOM FROM COMPETITION

Freedom from competition has a good side and a bad side, from the point of view of efficient production. A benevolent genius, fired with zeal to utilize industry as a channel for helping his fellow-man, could perhaps do more effective work with a monopoly than under competition. Thus Gerald Stanley Lee, in his book *Inspired Millionaires*, addressing the man who wishes to make his wealth a force for good in the world, gives as his

[1] See chap. v, p. 97 above.

[2] See chap. v, pp. 95-96 above.

first piece of advice: "Get a monopoly." This is the prerequisite to being free from the ignoble compulsions of the market; free to give both laborers and the public what they need rather than what competition forces them to take.

The moral is a doubtful one, however. If such a man were worthy of his mission, he could organize his industry so well that he need not fear competition, even if some of his missionary work involved an immediate sacrifice of commercial efficiency. If he could not make himself secure through efficient organization and performance, he would not be likely to mend his case by the tactics that are usually necessary in the process of getting a monopoly. For monopoly does not come ready-made; it has to be laboriously built up at the expense of a great many producers who want to remain independent. It must buy them out or force them out or make them willing to combine. There are ways of exerting such pressure, but they are not beautiful: such tactics are commonly of a sort that would furnish a poor background for a mission of social uplift. And aside from this, they are quite inconveniently expensive. In fact, to gain and keep a monopoly position, and fortify it so that the monopolist could deliberately reduce his commercial efficiency and still prosper — to do all this would almost certainly involve heavier burdens than the wastes of competitive salesmanship, great as they are.

These wastes of selling afford the chief opportunity for economy specifically traceable to getting rid of competition. The other savings often credited to monopoly are essentially economies of size, or of horizontal or vertical combination. Monopoly as such means more than this, and less. It means less in the way of economies of size, because it may be merely an agreement or cartel in which many small producers retain their independence and their individual inefficiencies. It means more in the way of coercive control over possible competitors, for it is of the nature of monopoly that it must be able to keep them out by other means than superior efficiency in production. Otherwise it has no monopoly, merely a differential advantage in a field that is open to all comers. All these things are relative and shade into each other, but there is a clean-cut and wide separation between the tactics which concentrate on achieving greater efficiency than is possible to small concerns, and enjoying the benefit of the difference, and the very different tactics necessary to make a still larger profit or to be entirely independent of what possible competitors might do. These last are the tactics of monopoly as such.

Monopoly as such, then, must be defined, not merely as a state of being, but in terms of the tactics necessary to establish that state of being and maintain it. So far as the state of being is concerned, it does not promote efficiency, but it does afford opportunities for it, in the field of selling. Under monopoly there could be a vast reduction of the competitive armies and armaments of billboards, circulars, traveling salesmen, and color-page advertisements, which, along with some real beauty, contributes so much to the ugliness of America, to the irrelevance of its landscapes, to limiting the ideals and ambitions of many clever artistic craftsmen, to the disappearance of our forests and the subsidizing of the more ephemeral levels of our literature—those which oftenest degenerate into the tawdry. Not all advertising could be saved. As has been urgently pointed out, some advertising is essential to large-scale production and the economies thereof, since the goods must find a wide market, or the large plant cannot be kept busy. Nevertheless, the necessary minimum for this purpose is a very different thing from the amount made necessary by the competitive struggle to keep one's own share of the large market or to get someone else's share away from him. Monopoly could save largely here.

Other economies, however, are slight or of doubtful character. Research does not gain by eliminating all duplication. Risks of competition are reduced, but in their stead appear the risks of public prosecution, and of the stagnation of improvement. On the other hand, there are serious elements of inefficiency involved in the attempt to gain control of the entire market, rather than to be content with a commanding position gained by limiting the combination to concerns of a high standard of efficiency. Inefficient concerns have a nuisance-value to a would-be monopolist which they would not have to a combination whose aim was to live and let live, and to get merely the benefits of size and superior efficiency. Weak producers must be absorbed, even though their plants prove useless and are closed down. This in turn may provoke the building of uesless plants as a form of industrial blackmail. The early history of the trust movement furnished glaring instances of combines overloading themselves with plants which were burdens rather than assets.[1]

More mature experience favors the live-and-let-live policy, though there is still a suspicion that patents are bought up for the purpose of putting them to sleep. Here, assuming the fact for purposes of analysis, we have overhead costs behaving strangely. A capital outlay is incurred, not to secure the aid of an instrument of production but to prevent it from being used, and from depreciating the value of existing processes by its competition. The act is essentially monopolistic, in that it involves control over the level of efficiency in the independent and supposedly competitive field of production.

Would a concern ever put to sleep a patent on a more efficient process than the one the concern was using? Presumably not, if (1) the efficiency of the new process were known with absolute accuracy, and (2) the saving were enough to pay a fair return on the capital sacrifice involved in replacing existing equipment before its natural time. However, both these conditions offer a deal of latitude and uncertainty. Within this uncertain margin, the tendency of a secure monopoly is toward the conservative course, giving existing methods the benefit of the doubt, while that of the competing concern is toward taking some chances, since a stand-pat attitude is the most dangerous one a competing concern can follow. A monopoly owning a patent which is on the doubtful margin is very likely to let it slumber, though it might give a substantial sum to prevent someone else from developing it. Even a patent known to be inferior may be worth buying and putting to sleep, if it is better than the run of processes used by competitors.

All in all, it seems clear that in most cases monopoly, taken by itself, or monopolistic practices, or the attempt to establish a monopoly, are all unfavorable to efficiency in the positive work of production. Monopoly makes some economies possible, *but the getting of it and the maintaining of it is likely to involve burdens that outweigh the benefits.*

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[1] Cf. Ripley, *Trusts, Pools and Corporations*, chaps. ix, x.

5. CONCLUSION

From the foregoing discussion it appears that where single plants are large, the forces making for both vertical and horizontal combination are strong. Since large plants are the natural accompaniment of the use of large proportions of fixed capital, it follows that businesses of large fixed capital tend to develop both horizontal and vertical combination. We have also seen that vertical combination extends the possible range of monopoly control, while the connection between horizontal combination and monopoly is obvious. Added to this is the well-known fact that it is the industries of large overhead costs in which unrestrained competition develops the cut-throat character which well-nigh forces the producers into some sort of combination, formal or informal, in order to avert disaster, or at least develop a standard of business practice which refrains from the tactics characteristic of unrestrained competition. It only remains to point out that where overhead costs are large, the risk of the initial investment is an obstacle to the free entry of new competitors, limits their possible number, and increases the risk that must be taken, with the result that the forces of "potential competition" are easier to control. Thus large-scale production, combination, and monopoly or restricted competition are all more or less bound together, and all occur in the same class of industries.

How great are the economies of combination? So far as horizontal combination goes, the most definite quantitative evidence is afforded by Dewing's study of thirty-five combinations, all of which merged at least five concerns which had formerly competed, and all of which had had a ten-year history before 1914, when the disturbances due to the world-war made further comparisons irrelevant.[1] He finds that the promoters of these combinations prophesied sufficient savings to increase their net earnings, on the average, about 43 per cent above their previous level. *This average included only serious estimates,* taking no account of what were obviously sheer exhibitions of rosy imagination. The outcome told another story, however, for the net earnings of the first year after consolidation averaged about 15 per cent less than the previous earnings of the constituent parts, while the result for the ten years following combination was still worse; about 18 per cent less than the previous earnings of the constituent parts, without allowing for the fact that considerable amounts of new capital were invested during the ten-year period. Thus the ten-year earnings were only some 57 per cent of the promoters' estimates, while the bonds and preferred stock had been arranged so that fixed claims on income would absorb nearly half the estimated net revenues. Thus a heavy percentage of reorganization was virtually inevitable, when the savings of combination turned out to be a minus quality.

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[1] Dewing, *A Statistical Study of the Success of Consolidations.* Mr. Dewing calls attention to the doubtful accuracy of the data on which this study had, per-

Evidently, horizontal combination is not a guaranty of savings. It is at best an opportunity, and an opportunity none too easy to seize and exploit. Both in practice and in principle it is hard to disentagle its effects from those of partial monoply. Eliot Jones, in his recent book, *The Trust Problem,*[1] states that of all the successful trusts examined there is not one whose success cannot be explained on other grounds than those of the efficiency resulting from combination.

It is fair to conclude that the chief forces making for horizontal combination are not the economies that result, but rather the natural urge to cease competing and combine. This is facilitated by the fact that increased size reduces the number of competitors and improved communication brings them closer together, with

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force, to be based. One probability is that the promoters exaggerated the previous earnings of the constituent concerns. Van Hise (*Concentration and Control*) presents a strong picture of the *possible* economies of combination, as implied in the wastes of competition, while Eliot Jones summarizes the actual achievements of the trusts in the unsparing fashion indicated in the following paragraph of the text.

[1] *The Trust Problem*, 1920, p. 539.

the result that combination of some sort, close or loose, formal or informal, is very nearly a matter of "manifest destiny." One modern observer has remarked that the telephone made the trust inevitable.

Such combination, however, does not necessarily carry with it the essential powers of monopoly except within narrow limits. Monopoly power is a thing of many vicissitudes, and since it is hardly ever favorable to productive efficiency, its exercise in the cruder forms is likely to be short-lived. On the other hand, vertical combination appears to be on a firmer basis in certain varieties of work, while in others specialization is going farther and farther.

CHAPTER VIII

DIFFERENT KINDS OF BUSINESS RHYTHMS

SUMMARY

Examples of business rhythms, 149—Causes of business rhythms, 153—Methods of control or adaptation, 159—The financial motive to regularization, 166—Other forms of motive, 169—Where regularization is impracticable, 171.

1. EXAMPLES OF BUSINESS RHYTHMS

Every economic activity has some irregularities, some ups and downs: and these have a way of recurring regularly, or with sufficient approach to regularity so that one may discern an underlying cycle or rhythm. These patterns, cycles, or quasi-cycles are a fascinating as well as an important subject of study. What are their causes? How are they met? Do they mean waste or efficiency? So far as they represent inefficiency for the producers, what means can be adopted to improve the situation, or is no improvement possible or desirable? Do the consumers demand irregularity, consciously or unconsciously? Do those who demand it pay what it costs? Would they demand it if they had to pay what it costs? Does anyone know what it costs? These and other questions arise and take varied and interesting forms in the different industries.

If every industry is subject to this phenomenon, examples might seem superfluous: however, a number of concrete cases will serve to emphasize the pervasive character of periodicity in business, and the different kinds of periodicity that are found in different industries.

One of the best recognized examples is the periodicity of the demand for electrical current for power and light. There is a very definite daily cycle and seasonal cycle, and the companies have taken definite measures to try to improve the distribution of demand, sometimes going so far as to change the character of the peak entirely, bringing it into a new time of the day. The demand for gas has a similar behavior, but in this case the companies can dispose of the daily fluctuations by storing a day's supply. The telephone and telegraph also have their own peaks of demand, and the night message is a familiar example of a policy aiming to utilize the slack time. The street railway also has its peak, and the suburban service of the railroads is affected in the same way. Different classes have their hours for travel and follow each other in waves—manual laborers, clerks, office workers, and, after a pause, the shoppers. Quite commonly there is an extreme concentration which results in enormous congestion, and yet if the company were to furnish enough trackage and cars to handle the "rush," these facilities would be idle most of the time. That is, unless at the same time the concentration of demand could be reduced in some practicable fashion.

Stores of different classes have their busy seasons and their busy hours of the day. Christmas and Easter are peculiarly active seasons, and also the periods just before customers leave the city for the summer holidays and just after they return. Mail-order houses have a weekly and a seasonal cycle to deal with: orders come in most heavily on Monday and there are also times when their customers are spending relatively little money, so that they find it worth while to conduct what are virtually special sales in such seasons. With theaters, the daily cycle is obvious, also the weekly and seasonal cycles. Hotels, resorts, and all places of amusement have their own peculiar rhythms. The city hotel has a different seasonal curve from the summer resort or the winter resort; and the city restaurant has a different problem from the automobilists' resort. Sometimes it is possible to eliminate most of the irregularity: sometimes a summer resort can be made into a successful winter resort also; but it is never possible to break up the habits of the people sufficiently to pull away as many vacationists in the winter as in the summer from the city as a whole. As a result resorts as a whole must still expect a long and relatively idle season.

Navigation on inland waters and in northern latitudes generally is another obvious case of periodicity, and so is the business of fishing, and of canning both fish and vegetables. Wherever the running of heating plants is on a large enough scale to occupy the full time of a worker, the irregularity in the demand for heating becomes important. Fortunately, in the nature of the case it fits in quite well with the closed season for navigation, so that stokers can frequently find work running heating plants when the inland waters are frozen. Coal mining, especially bituminous coal mining, is noticeably an irregular industry which gives employment for little more than two hundred days in the year, on an average. Since the demand for coal for heating is so definitely seasonal, perhaps the wonder is that mining is not even more irregular than it is. The natural antithesis to coal is ice, and many a dealer combines the two and improves his own percentage of usefulness thereby. The building trades are subject to the control of weather and the seasons, although less so than formerly, now that masonry and concrete can be laid even in freezing weather. Such things as the laying of sewers are done practically always at one time of the year, and few people would advocate trying to lay sewers in winter in order to secure a more even flow of employment.

Sporting goods again have their definite times and seasons and the manufacture of clothing, millinery, and such things is also extremely erratic on account of the changes in seasonal requirements combined with the uncertainties of style. Certain kinds of foods seem to be used principally at certain seasons: for instance, turkeys, while the "Friday fish habit" is fairly well established in many places where no one thinks of its origin. To a considerable extent, automobiles are also a seasonal product. Among the minor services, barber shops have a light business on Monday and a heavy one on Saturday while laundries are busiest in the first part of the week. This last is clearly a matter of custom which appears to have nothing back of it except the fact that the custom exists.

One of the largest seasonal industries of all remains to be mentioned: namely, farming. Planting time and harvesting time create their special demands for labor, and the farmer who finds himself able to get hands for a short season does so, and comes to rely on doing so, while the volume of this seasonal demand grows until it creates for the farmers an extremely troublesome problem, all because they have come to depend on such a difficult and fundamentally unreasonable method of getting labor. Fundamentally unreasonable, that is, unless it so happens that the rest of the industrial system can afford to turn loose the hundreds of thousands of workers whom the farmer needs, and can then re-absorb them without undue waste and uncertainty. Apparently, few people have seriously asked themselves if this is so; certainly not in the stage when the industry was fastening this habit upon itself.[1] Then there is the marketing of the farm crops and the transporting of them, which in turn is the largest single item in the seasonal cycle of the railroads. This last is an enormous and complicated cycle, differing for different commodities and in different sections of the country. Then there is the farmers' demand for fertilizer, seeds, farm implements, and machinery; all these are seasonal largely because farming itself is governed by the seasons.

And on top of all these cycles of irregular production there is the thing we have come to call the "business cycle," which affects all industry in a way which cannot be predicted. If it could be exactly predicted it could largely be prevented and one of the reasons it persists is that, despite business barometrics, no one can tell just how violent the swing will be or just when the turn is coming. Nevertheless, it follows in a general way a regular course of ups and downs. And industry has come to expect them, so that one of the chief subjects of business discussion is: In what stage of the cycle are we at the present moment?

From this list of examples it is clear that there are many different kinds of business fluctuations. Some of them appear to be quite inevitable, while others could be removed with very little trouble at any time it might seem worth while to remove them. Many of them involve serious waste of capital and labor, while about others there may be a considerable question whether there is any real waste involved. For a certain irregularity in doing things is characteristic of the human animal, and an absolutely rigid routine is not an efficient way to utilize his time and energy. So it will be worth while to look for a moment into the causes of these different kinds of cycles, dividing them, of course, into those that are daily, weekly, and seasonal and those which have a longer and more irregular period.

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[1] A recent article by Martha Bensley Bruère in the *Survey* (April 1, 1923, pp. 7–13) is one of the few serious attempts to grapple with this problem which have come to the writer's notice.

2. CAUSES OF BUSINESS RHYTHMS

The obvious basis of the daily cycle is the fact that man sleeps at night, eats before he starts to work, moves somewhere to get to his work, eats again before he finishes the day's work, and amuses himself after he is through. This means that under our system of division of labor, where some people are specialized to the job of carrying other people where they want to go, or amusing them when they want to be amused, many people's work will necessarily come at inconvenient times, judged by the general standard. Conceivably, if the bulk of industry and commerce were content to be as irregular as is local transportation or the work of amusing the multitudes, it would be possible to smooth out the curves of demand for transportation, theater performances, and other subsidiary services. But there is a natural convenience about having different branches of industry and commerce running at the same time, so that they can communicate by telephone, and hence any revolutionary change would be unreasonable. However, an adjustment of fifteen minutes or half an hour is sometimes capable of doing a great deal toward relieving the peak of such a service as street-car travel.

The weekly cycle is not quite so simple or inevitable as the daily one, but it rests chiefly on the Saturday half-holiday and the Sunday holiday and these should not be tampered with for mere industrial convenience. Here again, with our specialized system of transportation and amusement, some people have to work harder at those times of general recreation if others are to be given the facilities they demand for transportation and professionalized amusement.

The seasonal cycle is still more varied in respect to the causes at work. Sometimes it is demand that fluctuates, like the demand of the Christmas shopper, and sometimes it is supply, like the supply of fresh vegetables for the canneries, and there are derived demands, or demands for means of production, which fluctuate because of fluctuations in the productive activity they serve. Such, for example, is the demand for canning materials or for fertilizer and farm implements. Frequently the result is a joint effect of several causes, such as a combination of climate and custom. The climate is sufficient guaranty that people will not wear the same clothes in June as in March, but it is something entirely different from climate which concentrates so much of the change on Easter Sunday, and it is something different from climate which makes the styles change from year to year, so that last April's stock will be useless for next April.

One of the forces at work rests on the fact that the flow of services people get out of their durable possessions is one thing and the work of supplying those commodities is a different thing, and this work of supply may be concentrated, although the demand for the benefits which the user receives may spread itself over the entire season or longer. Just because durable goods do not have to be bought at any particular time, it is possible for the buyers to concentrate their purchases, and there seems to be something imitative or gregarious about the human animal which tends to make him do so. Even business men tend to concentrate their business purchases without inquiring very deeply whether it would be better for industry in general (themselves included in the long run) to distribute them on some more scientific schedule. It is hard to say which is harder on the producer, to produce something which has to be consumed the instant it is produced—in which case the producer has to be working at just the time which other people find convenient for recreation—or to produce something which the consumer is then able to keep and enjoy as he pleases, for then the producer is employed only during the season—possibly a brief one—when all the consumers are furnishing themselves with this commodity; and while they go on enjoying it the capital and labor that produced it may be idle. Seasonal migrations are a case in point, because people stock up with many things before they move.

It goes without saying that the effects of these different rhythms depend partly on their length and partly on their regularity and predictability. It makes a vital difference, also, whether you can predict not merely the time when the cycle will turn but also the particular kind and quality of goods and services that will be wanted to satisfy the coming peak of the demand. In other words, if the commodity is standardized the producer can be making a stock of it in the off season. If it were not for this possibility of "making to stock" the Christmas demand for toys and other gifts would be nothing short of an industrial calamity and St. Nicholas would be a curse to mankind rather than a patron saint. Clearly, the shortest rhythms are the easiest to predict, partly because there is less time for fundamental conditions to change from one peak to the next, and partly because it is possible to base one's prediction on the observation of large numbers of cases. Also, the shortest cycles create the least economic and financial disturbance. As far as labor is concerned, since it must have its rest in any case, it becomes largely a matter of putting the hours of rest at an inconvenient time of day or putting the weekly holiday at an inconvienent time of the week. In many cases the actual result is to make people work seven days in the week, although this is never a real necessity no matter what is the rhythm of the industry, unless the establishment is very small.

On the other hand, the seasonal cycles are long enough to involve what we call "unemployment," both of capital and of labor, and of course the longer cycles are worse in this respect because no one knows just when to expect them. From the financial standpoint, the shorter cycles make no trouble at all, so long as they do not result in an inefficiency that cripples the entire industry. The quarterly dividend period covers its regular thirteen weeks, and any weekly cycle has no effect on the quarterly dividend. A seasonal cycle, however, may mean that a dividend will have to be paid at the end of a series of three lean months, in which case there is the financial problem of accumulating reserves in the more prosperous season to meet dividend requirements in the dull period.

When we come to the business cycle of several years' duration this problem becomes more serious because the wait is longer and the recovery less certain. To a considerable extent, this lean period has to stand by itself, earning its own dividends if it can. Even if the concern lays by a surplus to carry it through the time of depression and then uses that surplus to pay dividends, the investing public will look on such a policy with more distrust than they would in the case of a regular seasonal industry which pays its dividend in the season of relatively low business but which can show that the business of that particular quarter bore such a relation to the usual earnings in that quarter as to promise satisfactory earnings for the whole year if the yearly cycle follows its usual shape. No railroad judges its prosperity by the earnings of the first three months of the year, because they are normally lower than those of late summer and fall. What the railroad asks itself is whether the earnings in that period constitute that quarter's usual share of a fair year's earnings.

To what extent do these irregularities constitute an evil? They nearly always involve some idleness on the part of the fixed capital, and where this is a very large item it amounts to an economic waste large enough to be worth considering quite seriously. However, no one seriously mentions that we are wasting productive power on account of letting machinery lie idle through the hours of the night when human beings need to sleep, because there is a worse waste if people are forced into unnatural habits in their hours of work and rest. In the same way, it does more good than harm if the pace of the work varies, in moderation. Short periods of strenuous exertion or even of overtime, followed by intervals when the strain is relaxed and when the hours of work can be shortened or other provision can be made for recuperation—these are on the whole better than a mechanically even routine.

However, as the wage system actually works, irregularities are not by any means handled in this beneficial way. Hands are laid off in the slack season and the result may be that those who are left work harder in order to make sure that they shall not lose their own jobs. Thus an added strain and worry is likely to take the place of the relaxation that might otherwise be possible.[1] Two things, then, are desirable. One is to reduce fluctuations, wherever possible, to such a moderate amount as can have the effect of relaxation rather than "unemployment," and another is to bring it about that fluctuations which might have this beneficial effect are actually so handled as to produce the best results possible in this respect, rather than leaving that matter to chance and the humanity of the employer.

If all labor were on the same footing as the salaried members of the administrative staff, this question would settle itself. The labor would constitute an overhead expense to the industry and the employer would find it to his interest to prevent "idle overhead" so far as that might be practicable, while the irregularities that could not be removed would not be the unmitigated evil which they too often are under existing conditions. However, it is not immediately practicable to transfer all labor to such a status and it will probably never be desirable to try to make such a system universal. It would certainly not be desirable to compel an industry that only operates in summer to keep its employees idle through the winter or to compel each particular employer to find, by his own efforts, some business in which he himself can profitably employ them through the winter. Especially if there are also other employers whose business only lasts through the winter, it would be extremely wasteful to force these latter to keep their employees through the summer or to find a summer occupation and go into it for the sake of keeping the employees busy. The more natural and obvious thing is for the employees to find their way from one employer to the other just as far as this is practicable without unreasonable risk and sacrifice to the employee.

The responsibility which employers in such cases can be reasonably expected to assume is a responsibility for helping to furnish easy channels for this mobilization of labor which the peculiar character of their industry demands and by which they profit. They make a saving out of not having to keep their labor through the entire year, but it is at the cost of a difficult, expensive, and imperfectly consummated mobilization of the labor force of the country. It costs money, consumes time, often interferes with family unity, and leaves a certain percentage chronically unabsorbed. It is reasonable, then, that the business should bear a part of the responsibility for this mobilization, and a part of the expense. An efficient labor clearing-house could cancel a great many of the seasonal demands against each other, but there would be a considerable remainder which could not be canceled, and for this remainder the seasonal industries are also responsible.

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[1] Henry R. Seager, in the *Survey* (XXXIII, 553), makes the point that a moderate irregularity of employment is labor's only chance for an equivalent for the vacations of more favored workers, but that as things stand unemployment does not have this desirable effect.

They are responsible for making reasonable efforts to absorb it, at some sacrifice if necessary. And if there is an irreducible minimum of unemployment which cannot be absorbed it should, by some method, be converted and distributed so that it would take the shape of a reasonable slackening of the pace of work for many workers rather than total unemployment for an unfortunate minority. If industry needs them at the "peak" and for the sake of the peak business, then the peak should bear the responsibility properly traceable to it, and if it cannot properly bear it, there is a strong presumption that the peak needs whittling down. This may, then, be set up as an ideal and actual policies may be discussed and appraised according as they are or are not in harmony with this standard.

In general, continuous employment of capital alone is not sufficient incentive to justify employing labor at unnatural times, especially at night. However, there are certain cases where the demand of the public is sufficient to justify night work for some employees or to make it virtually necessary. And in such a case, it is, of course, desirable that this night work should be as effectively utilized as possible: in other words, that the output at such times should come up to the reasonable capacity of the force which has to be employed in any case. This is probably a sufficient justification for making low rates for night messages by telegraph and telephone, so long as the business does not get so heavy as to call for additional operators beyond the minimum that need to be on duty if the lines of communication are to be kept open at all.

From what has been said, one pertinent conclusion may be drawn. It appears that the waste of idle capital is on the whole a desirable stimulus and guide toward removing unnecessary irregularities, but that it is not infallible. The effective utilization of labor power is more important. Where the attempt to utilize the full capacity of capital results also in the fuller utilization of labor it is, of course, a good thing and all that can be said about it is that while it works in the right direction it does not furnish a stimulus which is as large and powerful as the interest which society has in regularization. And in cases where the full utilization of capital requires a distribution of labor time which is undersirable for labor, either from the standpoint of welfare or long-run efficiency, then the labor consideration is virtually always paramount.

3. METHODS OF CONTROL OR ADAPTATION

We next come to the methods of controlling fluctuations of production, although some of these have already been suggested by what has just been said. So far as these cycles really involve waste, there are few, if any, which cannot be reached by some fairly adequate motives and methods, to improving them or to mitigate them. Such things as the daily cycle of work, food, recreation, and sleep will always take precedence over the convenience of some of the workers. Where nature furnishes supplies of certain things at certain seasons only, there is often no way of postponing or distributing the work that is involved, and here the only thing to do is to dovetail it as far as possible with other work, or to treat it as a special load to be borne, not by the employees only, but by the industry which is responsible. Its responsibility should not end with the coming of the off season. The only other possibility is to utilize workers who do not have to earn their living the year round, but who are willing to take some supplementary earnings. Even this resource is a risky one for the peace and stability of the industry in the long run, in case such semi-independent workers come into serious competition with others who are wholly dependent on their own earnings.

If one were to make a list of methods of improving the regularity of production, they would probably fall into three main groups. One works through the broad strategy of commercial organization to dovetail together different kinds of work with different seasonal characteristics. Sometimes the employer, in a seasonal trade, may himself find a complementary line of business as, for instance, the dealer who handles both coal and ice. Sometimes another employer may be attracted into some complementary line of business, setting up an establishment in the place where the workers are. It would be hard, for example, for farmers to set up household industries on the farm, after the model of the old handicrafts, to keep their workers busy in the off times of farming. They could hardly compete with large factories. But it is possible for some minor industries which can work on a small scale and require little fixed capital to move out into rural regions where they can furnish an easy outlet for farm labor. Their own capital will not be very well utilized; and they will suffer considerable idle overhead on this score, but if they can secure a cheap labor supply they may be compensated, and the benefit may be mutual. Now that farmers are organizing more and more, it would pay their organizations to investigate seriously the possibilities of this sort of dovetailing as a partial remedy for the problem of seasonal labor. In one farming village, for example, a small broom factory helps to fill in the winter months.

More often, probably, the labor will have to move to the industry rather than the industry to the labor. This is a mobilization in which the individual worker is at a hopeless disadvantage in trying to guide his movements intelligently. It requires, as has been suggested, a national clearing-house in order to bring all the possible supplies and demands together. In some cases, this would need to have international affiliations, where there are industries with different seasonal rhythms on opposite sides of an international boundary. The establishment or maintenance of a system of this sort, as efficient as it can possibly be made, is essentially a proper charge upon industry. It could very fittingly be maintained by employers and laborers jointly. The only really adequate possible objection to such an institution would be in case the workers, for one reason or another, were unwilling to co-operate or to trust an institution supported by the employers. In that case it could not serve its purpose, but short of inability to serve its purpose no objections would be adequate.

A second large class of policies consists of regularizing production without attempting to regularize the demand for the product, by simply storing the goods. Almost all factories do this to some extent: "working to stock" in slack seasons. The difficulties involved here are partly technical and partly commercial. The goods must be of a character such that they will be sure of an ultimate market, and the physical problems of storage must be met and overcome. In the case of clothing, for example, a concern generally has certain standard models which are made in large quantities, and the demand for these models can be counted on, so that they can be made in the off season. Blue serge suits in reasonably conservative styles are always safe to make. In the case of coal the problem is chiefly technical. Bituminous coal differs very much in its capacity to stand storage, and some kinds need to be stored under water. Also, if coal is to be stored without prohibitive expense, it must be done so as to avoid extra handlings; and this means storing it at the place where the dealer receives his coal from the railroad and loads it into his wagons for distribution, or in the stock pile of the industrial concern which consumes the coal. At the mines, coal is dumped from the mine car directly into the railroad car and storage at the mines would require an extra handling. Moreover, this would also mean that the railroads would have a more irregular coal movement than they have at present, because the coal would stay at the mines until needed for use, and thus most of the traffic in heating-coal would come at just the crop-moving time. Thus from the railroad standpoint the load factor would become worse rather than better. The question then becomes one of giving the dealers and large customers an adequate incentive to do their own storing in all cases where this would increase the general efficiency of the business as a whole. This is a rather difficult problem and we shall come back to it later.

Sometimes the natural resistances which any such change encounters can be overcome by enlisting the customer in a semi-co-operative method of handling the difficulty. Coal dealers sell coal cheaper in the spring, by way of giving the customer an incentive to do his own storing through the summer months. The efficacy of this depends fundamentally upon reasonable stability in the range of prices from year to year: otherwise the consumer can never be sure that he is really going to make a saving when he buys in the spring. The recent coal strike has probably created a bad break in the habit of buying ahead. One egg dealer has followed the policy of selling eggs during the cheap season for future delivery at any time during the next eight months, charging the current price plus a fee for storage, and thus giving the consumer the opportunity to take unto himself the profits of the cold storage dealer, so far as these are speculative.[1] Policies like these involve interesting questions of consumers' psychology and represent lines of experiment which ought to be more fully followed out.

In the third place, there is a whole series of possible devices which are purely commercial, consisting of trying to find a market for the product of the off season. This may be done by cutting prices, by developing foreign trade, or the trade of some other separate market especially in the Southern Hemisphere where the seasons are the reverse of ours. Or sales may be pushed in other ways through the activities of the selling department. These tactics take effect in different ways. Sometimes it is a question of different classes of business or different uses of a commodity, having different natural rhythms, so that if they are harmoniously developed, the result will be greater regularity for the whole. Thus electric generating plants may strive to increase the use of current for power, because that will fill in the daylight hours when there is little demand for lighting. Or they may develop new household devices—washing-machines, toasters, and vacuum cleaners—thus bringing into being a new demand with a better load curve than lighting. Or they may divide lighting customers into classes, theaters, residences, churches, etc., according as they have a better or a worse load distribution, so as to give lower rates to those classes which lay the least burden of idle capital on the central plant.

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[1] See Paul Atkins, "Solving the Problem of Seasonal Goods," *Administration*, October 1, 1921.

Here, however, it becomes doubtful whether such concessions as these, made to whole classes, can have much effect in improving the general load curve. The number of theaters or the frequency of church sociables will hardly be vitally affected by a moderate readjustment of the light bill. Such differentials must be based not so much on the promotion of more economical utilization as on the idea of inherent justice, leaving utilization pretty much as it stands but penalizing those who are responsible for the most expensive varieties of use.

In order to promote fuller utilization, where the proportion between different classes of use is fairly stable, it is necessary to reach the individual rather than the class, and to make it possible for any householder or theater-owner, if he improves the character of his own demand, to benefit thereby, without the need of being born again into a different class of users. There is a very important difference between policies aiming to improve the load by changing the proportions of different classes of business, and policies aiming to change the behavior of individual consumers within any given class by inducing them to improve the distribution of their demand. A still different class of policies are those based on abstract justice, without much likelihood of improving the load curve.

For purposes of modifying the demand, the cutting of prices is the simplest solution, where it will work; but it generally needs to be accompanied by some propaganda in order to overcome the inertia of the consumers and educate them up to taking advantage of the opportunities offered. In general, one would expect that the individual consumer would need more persuasion than the business establishment, because business establishments are generally supposed to be on the lookout for the cheapest time and place to buy their supplies, whereas consumers are more governed by habit. However, even business establishments do not seem to time their expenditures for the betterment of their permanent plants in such a fashion as to secure real long-run economy, though this is chiefly because the fluctuations that concern them most are the unpredictable movements of the business cycle. However that may be, a great deal has been done by making low rates for night messages by telegraph and long-distance telephone, for special uses of electrical current, for laundry work done in the last part of the week, and in other ways. Sometimes this means that new uses must be developed and sometimes it means that the consumer must simply be given a sufficient incentive to do his own storing.

A moment's consideration will show that the cutting of prices is more effective with some kinds of cycles than with others, and that it works differently with durable commodities and with perishable services. With durable commodities its effect rests not so much on stimulating increased demand or new uses as on inducing purchasers to time their purchases so as to create a regular flow rather than an irregular one. This may require the purchaser to store some of the goods for a time, and in such a case the maker has always the option of bearing the expense and risk of storage himself, in case the purchaser proves unresponsive to a reasonable stimulus. Thus the range of price-cutting is more limited in the case of durable commodities, and it is less likely to result in increasing the total demand.

In this respect, the "business cycle" stands in a class by itself, distinct from all other kinds of industrial periodicity, partly because the lean years must furnish their own dividends, partly because the time and extent of recovery can never be anticipated with sufficient certainty to make it practicable as a general policy to "work to stock" and to store up goods in advance, and partly because the cycle lasts so long that styles will change and specifications alter, so that few goods are durable in the sense of holding their economic value through the changing phases of boom and depression. Thus the business cycle is one which is, in its very nature, almost impossible to treat as a cycle at all. Private business is almost compelled—almost, but not quite—to treat each phase of it as a condition standing by itself.

Because of the inherent uncertainties of the case, cutting of prices is often disappointing in its results. Instead of stimulating purchases, as it would if it were a reduction good on Mondays only, or in February only, from a regular scale of prices with which the customer is familiar, it may merely lead him to wait for further reductions, and so, for the time being, have exactly the reverse effect from that which was intended. The lowering of prices could not permanently reduce the demand, of course, and in the end it could hardly fail to stimulate it, but the stimulus might not come until the reduction had lasted long enough to convince the market that bottom had been reached. And in the meantime, instead of concentrating, for instance, twenty days' demand into fifteen days, the effect might be just the reverse. This appears to be one of the things that is meant by the phrase "spoiling the market"[1] and it is in connection with the business cycle that this difficulty becomes acute.

In some cases cutting of prices seems quite irrelevant: for instance, in attempting to mitigate the burden of the rush hours on a city street-car system. Here there is no need of lowering fares to make the passengers eager to travel when the crowd is more moderate. Their own comfort is sufficient inducement. But they are governed by the opening and closing times of the shops and offices where they work, and if any change is to be brought about it is the employers' co-operation that must be sought, on a basis largely of general willingness to promote the efficiency of the whole economic system of the community in which they work.

Thus the cutting of prices is a measure that will not fit every case. Often special selling activities are more effective, with or without a reduction in price. Seasonal "sales" have a large place here, though they also serve the slightly different function of clearing the decks of an unsold remainder of seasonal goods. Some concerns hold salesmen's contests in the slack seasons;

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[1] Cf. Taussig, "Is Market Price Determinate?," *Quarterly Journal of Economics*, XXV (May, 1921), 394, 396–97.

some stimulate off-peak business by demonstrating new uses of their goods (vacuum cleaners and electric toasters and washing-machines help to even the daily peak, while walnuts and cranberries have been elevated from specialties for Christmas and Thanksgiving only to foods of general use). Mr. Paul Atkins, in an article from which many of the foregoing illustrations are drawn, tells how a group of automobile dealers bore the expense of plowing the snow out of the roads in their region, as a basis for a campaign to sell cars in winter.[1] When a summer resort undertakes to become a winter resort also, their chief problem is the development of a demand, rather than the reduction of prices.

4. THE FINANCIAL MOTIVE TO REGULARIZATION

These varied tactics have one essential feature in common. The establishment is willing to take off-peak business at a reduced price, or to spend an increased amount in storing, carrying, or selling the product, or in testing out and building up a scheme for dovetailing different products together, taking trouble and spending money which they would not otherwise spend. In every case there is a financial sacrifice incurred in order to improve the regularity of work. Back of this must lie the realization that more regular work is worth a financial sacrifice, and this realization is the ultimate motive in the case, on which the hope of effective action hinges. How adequate is this motive?

As a matter of impersonal and unmoral financial reckoning, it would seem that it pays to take off-peak business if that business is worth anything above the differential cost which it occasions to the concern. The question whether this fact furnishes an adequate motive depends mainly on three things. In the first place, it depends on the extent to which concerns know how large or how small their differential costs are. Cost-accounting systems do not show this, partly because they do not definitely set out to do so, being chiefly governed by other purposes and considerations, and partly because this information cannot be furnished, even approximately, without making departures from the methods characteristic of accounting, taken by itself. On this subject we shall have more to say later.[1] In the second place, the outcome depends on the business mores: the prevailing ideas and ideals of good business. It depends on whether they do or do not approve of sacrificing the usual return above differential cost, where necessary, in order to build up off-peak business. This in turn depends on so many factors that it deserves a separate discussion.

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[1] Paul Atkins, "Solving the Problem of Seasonal Goods," *op. cit.*

Thirdly, the effectiveness of financial self-interest as a motive to regularizing production depends on how closely the differential costs borne by the employer correspond to the true differential costs of added production to the industrial community as a whole, and how closely the residual or constant costs of the employer correspond to the burdens which the industrial community must bear whether production is maintained or not. This also is a far-reaching question, and all that can be done here is to indicate briefly what effect different types of business rhythms have upon it.

The willingness of business to recognize as sound practice whatever measures may be necessary to promote regularization depends partly upon keeping such concessions safely confined to off-peak business. For this purpose there is danger in the general principle that added business is worth taking at any price down to differential cost, because there may be an over-supply of productive capacity at the peak, so that the promotion of off-peak business would very easily degenerate into cut-throat competition and a general "spoiling of the market." This difficulty is lessened if the peak is regular and the cycle short: having a daily or weekly period. Seasonal ups and downs are harder to distinguish from a general and permanent growth or decline of business, and the "business cycle" is still more so. Where reductions to stimulate off-peak business are confined to special markets, or to special uses of goods, there is obviously less danger of running on into general destructive competition. This is, of course, most clearly possible when the concern deals in services rather than in commodities which can be stored.

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[1] See chap. xi, below.

It may be that irregular output has resulted in such inefficiency that there is considerably more labor and capital in the industry than would be needed to satisfy the demand if production were regularized, and in such cases regularization would be almost sure to precipitate destructive competition for a time, and to result in weeding out many producers and forcing many laborers out of the industry entirely. This would presumably be a salutary purge, from the long-run standpoint, but those in the industry would not naturally be inclined to invite it if existing conditions were tolerable: that is, if informal understandings and a general sentiment against "spoiling the market" were strong enough to maintain a living level of prices under the customary conditions of waste and inefficiency. Perhaps it would be invidious to cite the bituminous coal industry as an example, since that is merely an unusually conspicuous case.

Under what conditions do the constant costs falling upon the employer furnish a fair index of the constant burdens borne by the industrial community as a whole? In general, where there is so much fixed capital that maintenance, depreciation, interest, taxes, and insurance constitute a major part of the total expense, the employer's expenses are very largely constant, and consequently this question largely takes care of itself. Where a large part of the wage bill is constant, the same thing is true, only the wage bill must be constant in such unmistakable fashion that it will be clearly recognized as such. For example, in a seasonal industry the wage bill will fluctuate with the volume of work done, and yet it may be that the industry as a whole has to pay for the idle time because the season's earnings must be enough to attract the worker from other more regular trades. Obviously, no employer knows exactly whether this is true in his own industry, or just the extent to which it is true, consequently he does not know to what extent labor is a constant cost in his industry—meaning, in this case, a cost independent of the taking on of additional *off-peak* business. However, he knows that if he, alone, improved his load factor and afforded his employees 10 or 20 per cent more work in the year, he would probably still have to pay the same wages per hour or per piece as his competitors. In other words, labor might be a constant cost to the whole industry in the long run, under the general action of the laws of supply and demand, but this could only be determined by experiment, and in the meanwhile the experimenter would find great difficulty in reaping the benefits of his innovation.

This case presupposes that the labor is entirely or chiefly dependent on this particular industry for its support. If labor succeeds, on its own account, in dovetailing this employment with something else, then the situation is changed. An increase in off-peak business would not serve to fill up idle time but would have to bid against the alternative occupation. Added output "off the peak" would not be clear gain. Labor would not be a constant cost, even from the community point of view, and in such cases the employer's expenses might be a fairly good index of the costs which the industry imposes on the community. Financial efficiency for the employer and collective efficiency for the nation at large might approximately coincide, in the matter of making sacrifices in order to build up off-peak business.

These are but a few illustrations of the way in which particular forces work. These forces, and others, combine in so many different ways that each case must be studied separately. However, such a general discussion as this may be useful by way of indicating what to look for in studying individual cases, and pointing out some elements that must always be taken into account.

5. OTHER FORMS OF MOTIVE

The motives to regularization are by no means confined to a calculation of differential costs: indeed, on the whole, they are oftener cast in a different mold. "Lessening labor turnover" and "keeping the organization together" are recognized as desirable and economical, and it is becoming customary to pay considerable attention to these matters. If this is done merely on selfish grounds, however, there is some danger that it may go out of style, wherever it involves a very appreciable burden, since the financial gain to the particular industry is a very uncertain quantity, and is in any case far less than the gain in efficiency to the community at large. Such motives need to have added to them—or better still, to be merged into—the broader force of a sense of responsibility for the industrial wastes resulting from irregularity, no matter what form these wastes take or upon whom the burden falls in the first instance. In the most general terms, one can say that the shortest and most predictable cycles—daily and weekly—are the ones in which the motives of private profit are most adequate to do whatever needs to be done by way of remedy, and that the longer movements—the rhythms of the seasons and still more the uncertain swings of the "business cycle"—are the ones where a sense of obligation to promote efficiency is vitally necessary.

So far we have been considering the question from the standpoint of reducing irregularity as nearly as possible to the point at which there is no essential waste of productive powers. To this end the situation calls for discrimination in prices, or an equivalent discrimination in profits through undertaking extra selling outlays, assuming the burden of storage or of side lines yielding less than usual profit, all in order to build up the use of idle time and capacity. These discriminations may be given to all the off-peak business, or to some section of it that is capable of special development if such a section can be made into a class by itself.

On strictly logical grounds one might say that there is a presumption of waste if the off-peak business yields a material profit above differential cost, and if by using that profit as a subsidy to stimulate more off-peak business the load could be disdistributed more evenly. That is a hard saying, and private business cannot be expected ever to follow it literally. Some sections of off-peak business may be virtually inelastic, and in such cases this rule would not apply, for there can be no waste in refusing to cut prices to develop business that would not develop even if prices were cut. Street-car travel is probably a case in point, for reasons already discussed. Discriminations by themselves would have little or no effect, and any very radical smoothing of the curve could only be had at the cost of dislocating more important interests by disturbing the natural times of men's comings and goings. Transportation is a servant to enable people to go where and when they please, not a master to dictate their movements according to the Iron Slave's convenience. The same is true of the trades catering to the week-end holiday and the seasonal vacation with its migration to "resorts." Whatever inconvenience and inefficiency may be involved must be reckoned as a penalty attached to professionalized amusements, or to recreations which demand the help of any kind of economic services.

6. WHERE REGULARIZATION IS IMPRACTICABLE

What of the cycles which are not to be molded into greater regularity by economic incentives, either because they cannot be changed or because change would be undesirable? Here three questions remain: adequate compensation to the factors of production, some offset for its necessary irregularity, and a just apportionment of the burdens among those who receive the benefits. As for capital and enterprise, the question of their compensation is not the most pressing issue arising out of these periodicities. So far as the shorter cycles are concerned, the rewards of capital and enterprise are not disturbed. Hence only the longer ones need be considered, and even here the proverbial prudence and timidity of capital and the fact that enterprise specializes in the bearing of uncertainties are in themselves guaranties that considerable shrewdness will be expended in allowing for the rhythms of industry at least to the extent of guarding the average return to the enterprise. Against mere seasonal irregularities, this calculating foresight can be trusted to insure itself fairly well, but the business cycle is another story, and so large a story that it will have to be reserved for another chapter.

As for labor, there are great dangers, partly arising from the newness of our modern economic rhythms and the slowness with which labor realizes what is happening to it, and its still greater slowness in taking steps to protect itself. The physical effect of any given daily load distribution, under modern industrial conditions, is a matter often requiring expert diagnosis to determine. The best of all load factors, for the machine, is that of a steel furnace, when it is working at all, for it works twenty-four hours a day. But this is a very bad load distribution for the labor, since some have to work at night, the usual system being for laborers to take turns on the night shift, changing from one shift to another in regular rotation at intervals of a week. This, however, means that when the change is made, one shift has to work a double turn without stopping. It means also that labor has to choose either an eight-hour or twelve-hour shift, with nothing in between; thus does the Iron Slave limit his nominal master's freedom of choice. And the twelve-hour day, with twenty-four hours' continuous duty at the time of changing from day shift to night shift, is one of the worst load schedules, if not the worst, to be found in industry. The old-fashioned American lumberman's work was irregular and the strain and hardships of the log drive shortened the working lives of those whom it did not kill or maim outright, but there were compensations not found on a twelve-hour shift in a steel mill. These are merely conspicuous examples, cited largely to illustrate the lack of adequate knowledge of these matters.

Where business rhythms are changing, labor inevitably suffers, and industry may suffer in consequence of labor overloaded at the peak and underpaid through the average of peak and dull times. The longer and more uncertain the rhythm, the more surely is the average competitive wage inadequate. Unorganized labor of low grade is nearly always in a position to be victimized by the unsteady job, while if organization brings power enough to resist, there is no guaranty that the resistance will stop at the point set by ideal justice, sweet reasonableness, or industrial efficiency. In the end labor may protect itself so thoroughly, through limiting the working day, as to deprive itself of the still more fundamental privilege of doing a fair day's work for a fair day's pay. But this is a large subject, and would lead us too far afield. Suffice it to say that wherever industrial rhythms are changing, or methods of production are changing so as to change the effect of a given rhythm on the worker's physique and nervous system, the case clearly calls for careful study by the industry as a whole, and a wage policy based on the requirements of long-run economic efficiency, rather than on what the market will afford for the moment.

This does not involve any "violation of economic law" or departure from the type of recognized business practice, because, as we shall presently see, wages are not fixed on the principle of supply and demand, in the sense of making demand equal to supply at any and all states of the market and of the business cycle. They do not rise or fall as much as that would require. They are modified in the direction of a longer-run conception of supply and demand, colored by the conception of the "living wage." What is needed is a more conscious recognition of the place of industrial rhythms in determining the wage which will in the long run bring forth the needed supply of industrial efficiency. Perhaps labor should help the employer build up the off-peak business by taking lower wages at such times? Possibly, but this question must be left for later consideration. At the moment we are speaking of cases in which the hollows cannot be filled up, and in such cases a sacrifice of wages by labor would be useless.

How about the consumer in such cases? What does justice require in apportioning the price of the goods or services between buyers "on the peak" and off? It may seem strange that this argument has proceeded so far without once raising this question. However, we have been studying one kind of justice: that which looks to stimulating more and better utilization of the factors of production, checking the growth of business that might swell costs, and promoting the growth of business that would reduce them. Apart from such actual effects, the question of justice between one consumer and another seems abstract, if not academic. It is the least important of all problems arising from the rhythms of business. If prices can have no effect on the shape of the cycle, there would seem to be no particular reason for discriminating between the business that is really responsible for the lion's share of the capital charges and business which is responsible for none of them. For instance, the five-cent streetcar fare—in cities where that convenient unit of charge still prevails—is quite satisfactory as a basic rate and no departure from it would serve any useful purpose in improving the load-curve. So far as the promotion of efficient use is concerned, off-peak business can best be charged the same fare as rush-hour business. If any discriminations are made, they should be justified on other grounds, and if any serious attempt is made to improve the load curve, it must work through other methods and use other incentives.

DIRECTOR OF INDUSTRIES, BENGAL.
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CHAPTER IX

DIFFERENT COSTS FOR DIFFERENT PURPOSES: AN ILLUSTRATIVE PROBLEM

SUMMARY

The story of an imaginary plant, 175—Nine typical problems, 177—Different functionaries concerned with these problems, 180—The basic data, 183—First problem—to build or not to build, 186—Second problem—how large to build, 188—Third problem—a change of productive methods, 191—Fourth problem—income available for dividends, 192—Fifth and sixth problems—differential cost of added output, 194—Seventh problem—a temporary shut-down, 198—Eighth problem—a side line, 199—Ninth problem—abandonment, 200—Conclusion, 201.

I. THE STORY OF AN IMAGINARY PLANT

We may start with the general proposition that the terminology of costs is in a state of much confusion and that it is impossible to solve this confusion by discovering and adopting the one correct usage, because there is no one correct usage, usage being governed by the varying needs of varying business situations and problems. It is not even possible to settle the dispute as to whether interest is a cost of production or not, otherwise than by saying that it is a cost of a certain sort, which needs to be taken into account for certain purposes and not for others. In the same way "constant and variable costs" appear to mean different things for different purposes. This type of conclusion, beautiful as it may be in its tolerance, is nevertheless, by itself, formless and negative. The best way to give it positive meaning is to work through a series of different concrete situations and show in each case what cost means and why.

For that purpose let us take an imaginary plant and follow it through its life-history in a simplified and abbreviated form, picturing a few of the typical problems which must be met by the management and whose solution will hinge on a correct knowledge of costs. We shall find, first and last, quite an array of questions and an equally varied assortment of answers, including what may be called the total economic cost of the enterprise, the financial expenses or outlays for which the concern is legally liable, the variable costs or differential costs involved in particular policies which the concern has the option of following, and the costs which are constant, or unaffected by a given policy. We shall find that costs which are constant with reference to one policy may be variable with reference to another. Let us, then, state this series of problems, indicating what we would need to know in order to work out correct answers. We need not be bashful in calling for information, for our imaginary department of internal statistics and cost analysis is not subject to the limitations that hedge actual cost accountants, and can tell us anything we require to know about the cost of our business. In other words, we are seeking to study the true nature of costs, about which actual cost-accounting systems give only an approximation.

What is the use of this assumed omniscience, in view of the fact that cost accounting must deal in approximations and somewhat arbitrary allocations of general items? The use is that such a study will shed a deal of light on the question whether the sort of approximations actually used in cost accounting are the most appropriate and useful for the purposes for which they are used. Perhaps one kind of approximations would come nearest that truth which is significant for one purpose, and another kind would be more accurate or more appropriate to the requirements of another purpose. We shall try to make our problem more real by assuming some of the more important data, doing our best to make them true in the sense of being typical, and then we can work out answers in dollars and cents to the questions proposed.

Our answers will sometimes be different from those which a regular cost-accounting system would produce: indeed they will be different from those which any practicable cost-keeping system could possibly produce. This is done (to reiterate) in order to direct attention to the true nature of the goal at which the approximations of cost accounting ought to be aimed. One's approximate estimate is likely to be a great deal better if it is at least aimed at the thing one really needs to know than if it is aimed at something else. Thus the chief use of this study may be to help us to see whether actual cost-accounting systems aim at the things a manager would need to know if he had omniscience at his disposal. If they do not, then increasing accuracy is no improvement.

In order to make our supposed omniscience as reasonable as possible, we shall simplify the problem by making the plant turn out a homogeneous product. This eliminates the difficulty of tracing the costs of different grades or types of product, but leaves the problem of constant and variable outlays. Furthermore, when output is homogeneous it is fair to assume that one unit costs as much as another, barring accidents, and the increased cost due to taking on additional business can be studied by watching how the total expenses behave. This is a much neglected device of analysis which can be used to fairly good effect, even where the output is quite varied in character. Though it could, of course, never be a substitute for cost accounting, it could always be a valuable supplement to it.

2. NINE TYPICAL PROBLEMS

The problems we shall take up are the following:

1. The plant is not yet built, and the problem is whether the building of a new plant is economically justified or not. The data include the probable selling price, probable volume of sales, and the whole economic sacrifice involved in raising the necessary capital and building and operating the plant.

2. The plant is not yet built, and the problem is how large to build it. This involves chiefly the question what size of plant will produce goods at the lowest total economic sacrifice, together with the question whether the market will take the product without leaving too much idle capacity. The data are the same as before, but with separate estimates for different sizes of plant.

3. The plant is built and in operation, and the problem is whether it is economical to change the methods of production. The data include any and all differences in the sacrifice involved for the ultimate owners of the business between the present

methods of productions and the proposed substitutes. This includes any sacrifice on account of additional capital required.

4. The plant is built and in operation, and the problem is: What income is available for dividends? The decisive consideration here is the fact that dividends must not trench upon capital, and the data include all using-up of assets or incurring of liabilities, in the course of production. The corporation need not concern itself with the ultimate sacrifice of the individual investors; but merely with its own legal liabilities as a corporation.

5. It is estimated that a reduced price will make possible increased sales, and the problem is how cheaply it will pay to sell goods. Starting with a given output, we have to find the cost attributable to a certain amount of additional business for purposes of deciding how cheaply we can afford to sell these additional goods. There is presumably some minimum limit; and below this minimum the concern will be poorer for having taken the additional business than it would have been it if had not taken it, while above this minimum the concern will be better off for selling goods than for not selling them. The data needed for an accurate decision include the total sacrifice of producing the larger supply of goods, the total sacrifice of producing the smaller, and the total difference between the two. We shall also need to know whether any reduction in price must apply to the entire output, or whether additional goods can be "dumped" in a new market or sold in some other fashion which will leave the existing business at existing prices unimpaired. In the latter case, any income above "differential cost" is clear gain, while in the former, the gain from the new business must be large enough to compensate for the loss involved in reducing prices on all the goods now sold. In practice, the actual condition is likely to be intermediate between these two cases, because it is generally possible to classify one's business so as to give special reductions to certain classes, while at the same time it is impossible to avoid some leakage from one class into another. There are some other things which also make a difference, as we shall presently see.

6. Competition becomes increasingly keen and threatens to cut into the existing sales of the concern. The problem is how low the concern can afford to cut prices in order to hold its business. The only difference between this and the preceding question lies in the fact that the effect of a decrease of business is not quite the reverse of an increase, but for most purposes this difference would be negligible.

7. A depression occurs, and the problem arises whether the plant should be shut down temporarily, pending revival. The data would include the value of any products that might be turned out, the cost of turning them out, and the costs that would have to be borne if the plant were shut down. This last involves loss of trade connections, the cost of rebuilding a disbanded labor force, or the cost of retaining a nucleus of picked men through the shutdown and then of gathering a new force around them. Here we have imponderables which can only be roughly estimated, so that the actual decision may depend largely upon what is customary, or what is regarded as good policy in the long run for this business as a whole, or for the community at large. For that matter, the same could be said of the problems of price-cutting; the calculation of the financial interest of a business enterprise involves imponderables which are matters of judgment and are sufficiently indefinite to leave considerable margins within which the decision may be swayed by a mixture of custom, standards of sound business, the mob mind, and other forces of social psychology.

8. It is proposed to develop a side line which can keep the plant and working force occupied during seasons when experience shows that the main product is in slack demand. The problem here is: What are the costs attributable to this side line for purposes of determining whether it is worth undertaking? The data here should include, if possible, the whole economic sacrifice involved in producing the main product with the side line and without it, and the difference between the two. Lacking these data, we might be content with the costs on account of materials, labor, and capital directly devoted to the side line, minus such part of these burdens as would have to be borne in some form or other if the side line were not undertaken.

9. *Finally we come to the stage at which the question arises* whether this plant is no longer needed, and should be permanently abandoned. Possibly the producers in this branch of business have installed more producing capacity than the market justifies and this plant, being no longer new, is feeling the pressure with peculiar force. The problem here is: after everything has been done which can be economically done to rehabilitate the efficiency of the plant, what are the minimum earnings necessary to justify keeping the plant in operation? In other words, what are the costs attributable to keeping the plant going rather than abandoning it? The question is like that of building a new plant, with one vital difference, namely, the plant is built and cannot be unbuilt without losing most of the investment. The capital sum that is really sacrificed by keeping the plant in operation is not the entire original investment but only the salvage value of the plant and equipment as it now stands. The difference between the original investment and the salvage value is a "sunk" cost, a matter of historical interest but not affected by any subsequent acts of the management.

3. DIFFERENT FUNCTIONARIES CHARGED WITH THESE PROBLEMS

These nine problems are taken merely as types, and it goes without saying that they could be expanded and multiplied indefinitely. So far, we have not raised any of the questions of allocating costs as between different brands or classes of output. There will be goods of different sizes, patterns, and qualities; there may be some orders calling for special equipment and others which can be filled by the regular machines, with or without special adjustment. There will be large and small orders, or special designs for which a large or a small sale is to be expected.

These are all problems of cost, in one sense or another, and their number and variety are truly surprising. It is worth noticing, too, that to a large extent these different problems have to be faced by different people, playing different rôles in industry. For instance, the first problem, whether to build the plant or not, is that of the promoter and the investor, if the entire enterprise is new, or a problem for a general council of the highest responsible authorities if it is an established enterprise which is thinking of building an additional plant. Also, as the reader need not be told, this problem dominates the economists' notion of cost of production in the general sense: the entire financial sacrifice involved in entering upon a given venture rather than keeping one's labor and capital wholly out of it.

The second problem, that of large-scale or small-scale production, must needs come before the same supreme authorities for settlement, but for their specific data they will call in one special functionary, the engineer, whose peculiar duty it is to prepare advance estimates of the cost of constructing and operating a plant, and to compare the cost and efficiency of different types of plant. Such estimates should be checked, of course, by the judgment of experienced operating men and possibly others. The engineer may have something to say, also, about the third question, that of adopting new processes or new types of equipment after the plant is in operation. Where the change under consideration is a major one, the chief engineer's estimates will usually be the principal evidence used.

The fourth problem—that of the amount of income available for dividends—stands in a class by itself and is plainly in the province of one group of specialists, the general or financial accountants. This problem calls for cost in an absolute sense, while all the others call for a comparison of the costs involved in two different policies. The only other problem which approximates a search for absolute cost is the first; the entire sacrifice of raising capital and building a new plant, viewed prospectively, before the management commits itself to a decision. Here the alternative is not positive and specific, but negative and general. It is the alternative of staying out of this venture. One must needs assume that in any case some use will be made of the capital, labor, and brains involved, if not in this business, then in some other. However, no specific alternative is given, and none is needed in order to make a sufficiently workable reckoning. The rates of reward available in the general market are definite enough to serve the purpose.

With problem five, that of cutting prices to increase output, and indeed all the other problems with the possible exception of the taking on of a side line, we enter the realm of the cost accountant, or the region of problems where the chief data for solution must come from the cost accounts. These are problems of policy in a going concern and they hinge on a knowledge of costs, but they are all questions of alternatives, and do not hinge on cost in any ultimate or absolute sense. Problems five and six represent the differential or variable cost due to an increase or decrease of business; problems seven and nine hinge on the costs that cannot be avoided even if the plant stops working, and problem eight (the side line) represents the peculiar case of business which can be counted on to fill in the low spots in the utilization of the plant and working force without taxing their capacity when the high spots come. It is a problem of "off-peak" business, not properly chargeable with its full share of the peak or capacity costs.

Finally there might be raised certain broad questions of social policy, which are capable of being stated as problems in social accounting. When a shutdown is contemplated, what are the comparative costs involved from the standpoint of the business community as a whole, or of the nation? Are there costs which one industry can throw off upon other industries, or one individual throw off upon other individuals? Are there national overhead costs which are not borne directly by the business enterprises which are responsible? This is not a business problem, in the commonly accepted sense, but rather a problem for the statesman or the philanthropist. But it is rapidly becoming evident that statesmanship and philanthropy alone cannot solve it, and that unless business takes it up as a business problem it will not be solved.

It is not necessary for business to become philanthropic and unbusinesslike; it is merely necessary to look at the productive machine as a whole and consider the effects things have on its aggregate efficiency. If a national chamber of commerce is possible as an organ of business, the corresponding nation-wide view of the business organism should also be possible. In this respect the study entitled, *Waste in Industry*, made and published under the auspices of the Federated American Engineering Societies, is a sign of much promise. But this is aside from the purpose of the present chapter. However much these diffused costs may need to be studied as a matter of national cost accounting, we are here concerned with costs in a narrower business sense.

4. THE BASIC DATA

Even before trying to solve these different problems, we can see in advance one feature of the results, namely, that the answers will all be different. No one formula could be made by an accountant which would distinguish between constant and variable expenses in such fashion that it could be used to get the correct solution of every one of these different problems. But before this can be tested, we must sketch in the main facts about this fictitious plant.

We are making, let us say, a five-passenger touring car or fabricated lifeboats of a uniform design, or any other fairly standardized commodity. We find that the demand for this sort of commodity fluctuates so that the minimum over a term of years is likely to be about half the maximum, and the average about three-quarters of the maximum. The plant we originally contemplate building, and the capitalization we plan to go with it, produce the following balance sheet:

Assets (at Cost)		*Liabilities*	
Land	$ 30,000	Common Stock	$100,000
Buildings	70,000	Bonds (at 5 per cent)	100,000
Machinery	100,000	Floating debt for working capital	20,000
Materials and working capital (when working at designed capacity)	20,000		
Total Assets	$220,000	Total Liabilities	$220,000

The capacity of this plant, when working an eight-hour day, is one hundred cars a year. In question 2 we shall consider larger or smaller plants, but this is our point of departure. Working capital, of course, will fluctuate with volume of business. Ultimately we hope to accumulate a surplus which will provide for working capital, but for the present we borrow it from banks.

As for the cost of operation, any intelligent person could predict that it would vary as output varied, though by no means in exact proportion. For some of our problems it is going to be essential to know how it does vary, and we may as well know now as later. For this purpose we may construct a series of simplified budgets showing what happens to each main item, from a state of temporary shutdown up to a state of 20 per cent overload.

Interest is included, not to prejudge the question whether it is a cost or not, but because we shall need interest figures for some of our particular problems. The series of budgets is shown on page 185.

Just a word as to the story that lies behind these figures. The labor force is so small that elasticity in the wage bill has to come mostly in other ways than from taking on or laying off full-time workmen. It comes through various things: piece-wage systems for the direct labor; part-time or overtime for most of the laborers (with overtime pay at extra rates), etc. When new men are taken on, there is waste in teaching them, and a certain amount of slackness due to the force feeling more secure of their jobs. The figures also assume that when output is pushed to 20 per cent beyond normal, accidents and spoilage of material increase out of all proportion. When men are laid off the rest work harder. There are certain "key men" whose experience in this particular industry is so valuable that they cannot be laid off without a very heavy loss, and they will be kept on even through a shutdown if it is not expected to be a long one. Promising learners may be favored somewhat. Materials and working capital are supposed to vary in proportion to the volume of business, and floating debt varies accordingly. Later, if the concern accumulates a surplus, the form of these items will change somewhat, but without material effect on the totals. Stockholders' equity would be increased, and floating debt, now covering only a part of the working capital, would fluctuate more than output.

TABLE I

COSTS—RATE PER YEAR AT DIFFERENT RATES OF OUTPUT

Division	Position	I			II		III		IV		V	
		Rate of Output										
		120 Per Cent of Capacity		100 Per Cent of Capacity			80 Per Cent of Capacity		60 Per Cent of Capacity		0 Per Cent of Capacity (Temporary)	
		Total Pay	Division Totals	No. Men	Total Pay	Division Totals	Total Pay	Division Totals	Total Pay	Division Totals	Total Pay	Division Totals
Office, Sales, etc.	Manager	$ 5,000		1	$ 5,000		$ 5,000		$ 5,000		$ 5,000	
	Assistant	2,000		1	2,000		2,000		2,000		2,000	
	Clerk	1,800		1	1,500		1,600		1,800		1,000	
	Stenographer	3,500		2	2,800		2,800		2,800			
	Materials	600			500		400		240			
	Trav. Salesmen & Adv.	6,000			4,000		3,600		3,400			
	Law & Auditing	1,200	$20,100		1,000	$16,900	1,000	$16,400	1,000	$16,240	1,000	$ 9,000
Repairs and Maintenance	Key Man	$ 1,000		1	$ 1,500		$ 1,500		$ 1,500		$ 1,200	
	Helpers (a)	800		1	600		600		600			
	Helpers (b)	1,400		1	600		600		400			
	Materials	1,800	5,000		500	3,200	450	3,150	460	2,960	200	1,400
Indirect Costs of Operation	Engineer	$ 2,000		1	$ 1,500		$ 1,500		$ 1,500		$ 1,200	
	Stokers	2,800		2	2,000		1,600		1,600			
	Sweepers	2,200		3	2,100		2,100		2,100			
	Watchmen	700		1	700		700		700		700	
	Storekeeper	1,800		1	1,600		1,600		1,600			
	Coal & Materials	11,500	21,000		10,000	17,900	9,200	16,700	8,600	16,100		1,900
Direct Costs of Operation	Foremen	$ 3,000		2	$ 3,000		$ 3,000		$ 2,400		$ 2,000	
	Key Men	7,200		4	5,600		5,200		4,500		4,000	
	Mach. Operators											
	Skilled but unspecial	13,000		7	9,100		7,800		6,500			
	Unskilled	16,000		12	12,000		9,500		8,000			
	Learners	2,800		2	1,700		1,200		600			
	Materials	26,000	68,000		20,000	51,400	16,000	42,700	12,000	34,000		6,000
Overhead Charges	Taxes	$ 4,000			$ 4,000		$ 4,000		$ 4,000		$ 4,000	
	Depreciation & Ins.	6,800			6,800		6,800		6,800		6,800	
	Interest: Bonds	5,000			5,000		5,000		5,000		5,000	
	Stockholders											
	Equity	7,000			7,000		7,000		7,000		7,000	
	Floating Debt	1,440	24,240		1,200	24,000	960	23,760	720	23,520	600	23,400
Total	....	....	$138,340	....	....	$113,400	....	$103,000	....	$92,820	....	$41,700

Cost per car at 60 per cent	$1,547
Cost per car at 80 per cent	1,287
Cost per car at 100 per cent	1,134
Cost per car at 120 per cent	1,153
Cost per car, weighted average	1,300 (including one day of shutdown for every eight days' operation).

Differential cost, first 60 cars (IV–V)	$51,120 or	$852 per car
Differential cost, next 20 cars (III–IV)	10,180 or	509 per car
Differential cost, next 20 cars (II–III)	10,400 or	520 per car
Differential cost, last 20 cars (I–II)	24,940 or	1,247 per car

There are many things of which such a table cannot possibly ake account. One is, of course, the division of costs between ifferent brands of output. Another is the subtle effect of time, or the cost of working steadily at 60 per cent capacity, for xample, would be one thing and the cost of a few days' operation t that rate, sandwiched in between days at full capacity or days f absolute shutdown, would be something different. Change tself costs something. The figures in the table may be taken o represent a rough average of these different sorts of conditions, either the highest nor the lowest, and therefore we must not ollow them slavishly, but be ready to make allowances for special ircumstances. And with this caution let us turn to the first f our special problems.

5. FIRST PROBLEM—TO BUILD OR NOT TO BUILD

The plant will justify itself if it yields the investors as much r more clear income than they could have been reasonably sure f getting in any other line of investment. This means, of course, aking good years with bad and perhaps reserving something as ompensation for the risk of ultimate failure or partial loss, of he sort which is suggested by the final problem in our series. Vhen the original investors decided to devote their funds to his venture, their act cost them something; they sacrificed uch rival opportunities as the market afforded for the investment f their funds, and unless this business compensates for that acrifice, then they are out of pocket for having gone into it.

It has been suggested that if a business man sacrifices one pportunity where he has a virtual certainty of large profits in rder to embark on some other enterpise, the profits of the first usiness are a cost which he incurs if he engages in the second usiness.[1] In principle this is quite correct, if cost means any sacifice incurred as a result of undertaking the production of any iven commodity. However, if we limit ourselves to what is ypical, we shall rule out the case of a man who is certain of large rofits in one industry and yet expects to be able to make larger rofits in another. Such children of fortune are rare; moreover, no one can ever calculate just what profit he is giving up, and if one is going to label such a sacrifice a "cost," he should confine his estimate to things that are reasonably certain and calculable, for "cost" is supposed to rest as much as possible upon objective fact and as little as possible upon hypothesis. The market rate of yield on conservative investments is calculable enough for this purpose, but a hypothetical 25 per cent profit must always be a matter of chance. Six per cent on the entire investment would be a fair figure, and this amount is an essential part of the economic sacrifices involved in producing these goods.

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[1] See Davenport, *Economics of Enterprise*, pp. 60–64.

This fact alone would not make it necessary that the accountants should charge interest on the books as a cost; this is not needed to enable the investor to take it into his calculations. The keeping of the books of account is governed by a number of other considerations, some of which favor including interest while others favor excluding it. What is needed, however, is that accountants and others should recognize clearly that, even if interest is not treated as a cost in the general books of account, it must be reckoned as such for certain purposes, including the problem we have now before us.

In the same way, if any of the owners contribute valuable services without salary, these constitute a sacrifice of production in the same way as the stockholders' investment. The simplest way, for the accountant, is to pay a salary in such cases, and yet if a stockholder is willing to take his share in the profits as his reward, the concern is obviously that much safer, and nothing should be done to diminish that safety unless there is some stronger reason than mere convenience or consistency of accounting ritual. Here again what is needed is a readiness, whenever a problem comes up which requires it, to take account of productive sacrifices in the way of personal service even though the company does not pay a money stipend for them and they do not appear as a cost in the formal books.

How shall we estimate operating expenses, in view of the fact that they vary with output? In the first place it is obvious that if one estimated cost on the basis of always expecting to work at 100 per cent capacity, the answer would be too low. It is equally true that, if 80 per cent represents average conditions, an estimate based on steady operation at 80 per cent of capacity would be too low. Overtime work is expensive, and work at 60 per cent capacity is expensive, and work at 80 per cent to 100 per cent is more efficient than either, so far as operating expense goes, while the change from one to the other is expensive in itself. So instead of estimating the average rate of output and finding the cost of that, we should estimate the cost of working overtime, the cost of a shutdown, and of all the intermediate stages. And then we should average these costs, weighting them so as to give a fair picture of the probable facts. The table of costs already worked out will furnish the materials for this kind of an average. If we average all the columns, giving the "shutdown" column half the weight of the others, the result will represent an average output of exactly 80 per cent of full capacity, which is about what business men regard as a typical percentage and is made up in a fairly typical way. The resulting average is $1,300 per car, as compared to $1,287 per car if production were steady at 80 per cent of capacity, and $1,134 per car when working at 100 per cent.

The probable total economic cost per car, is, then, $1,300, if production averages 80 per cent of capacity. If the concern can sell eighty cars a year at an average price of $1,300, the enterprise will justify itself. If output is lower, cost will be higher and vice versa. In any actual estimate a wide margin would need to be added for errors and optimism, but we have already made a specific allowance for wastes of partial utilization, amounting to nearly 15 per cent of the figure for perfect utilization —which is frequently the only one actually calculated by an engineer. All estimates of cost should include a specific allowance for this factor before beginning to make more general allowances for omissions and unforeseen contingencies.

6. SECOND PROBLEM—HOW LARGE TO BUILD

An answer to the preceding problem really presupposes an answer to this one, but for convenience we may separate them. This question of size of plant is really a many-sided one, involving limits set by available capital, by the present demand, and by its prospects of future growth, but a full analysis of these would lead too far afield. There are, for instance, important principles involved in building ahead of present needs, in order to be prepared for future growth without the expense of rebuilding, but for the present we may confine ourselves to the question of the most economical size of plant.

If an engineer were asked to make an estimate on such a question, he would probably have to build, on paper, two plants of different capacities and compare their costs of construction and operation. If he were very thorough he would do for each plant what we have already done for our original plant: that is, make a schedule of costs of operation at different percentages of capacity, from nothing at all up to an overload, and strike a fair weighted average in each case.

The difference between these averages would represent the cost of the added output made possible by the larger plant. So long as there are any economies of large scale production to be had, this difference in cost, divided by the difference in average output, would be less than the average cost for either one of the plants. However, if the plant outgrows its possible market, the economies of the large productive unit will be neutralized by the wastes of partial utilization. In practice, there would probably always be some economies technically possible, which would appear on an engineer's estimate, but which might be counteracted or canceled by losses in efficiency due to the human factor; for there are limits on the power of the management to secure efficient co-operation in a larger and more complex enterprise.[1] Because of this inherent weakness of preliminary estimates it is very necessary to supplement them with data drawn from the past experience of similar concerns. This is what the experienced business man does, by judgment or intuition, if not by statistical analysis.

How will the larger and smaller plants compare with each other? An increase in size of plant will involve an increase in practically every item of expense: interest on investment, taxes, depreciation, insurance, and operating expenses. The cost of securing added business, then, by increasing the size of the plant, includes a share of all these items, but not necessarily a pro rata share. In general, investment will probably increase faster than operating expenses, for the reason that the larger the plant, the more things it will pay to do by machinery and the smaller will be the proportion of direct labor to insurance, taxes, and interest on the equipment employed. Thus one writer has collected figures indicating that, in general manufacturing, operating expenses per unit of product tend to decrease with increase in size of plant without apparently ever reaching a limit, and yet the largest plants are not the most profitable.[1] If this is a fact—and it seems plausible—it must be explained by the fact that overhead costs increase faster than operating expenses, overhead costs including all outlays on account of investment.

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[1] Alfred Marshall mentions some of these drawbacks of size: *Principles of Economics*, pp. 284–85; also in *Industry and Trade*, pp. 321–23.

Thus the fact that the costs of direct labor, or even total operating expenses, are smaller for the larger plant, proves nothing as to its being the most economical one; the question is: Does the saving compensate for the additional investment? For the sake of conservatism, some concerns never make a betterment unless it can show a probable saving equal to double the interest on the capital involved. This would undoubtedly be wise policy in businesses which are not markedly stable, especially if the estimates of cost on which the whole caculation rests do not allow enough for partial utilization, or for the risk of premature obsolescence or for the fact that costs of labor and materials may change in the future in such a way as to vitiate the original estimates. For any such decision commits the concern for the life of the equipment in question, which may be ten or twenty years or more, and therefore the decision made today will have to justify itself under all the unforeseen contingencies of an entire future generation of machines. In some large industries, where a change of equipment cannot be made all at once because there is not enough capacity for making the new equipment, the process must begin with the building of machines to make the machines which this concern is planning to instal, and this will look forward two mechanical generations or more—perhaps fifty years in all.

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[1] Kotany, "A Theory of Profit and Interest," *Quarterly Journal of Economics*, XXXVI, 413–53.

Clearly the allowance for risk should be large, and the amount of risk depends partly on the size of the investment and partly on various elements of operating expense. These facts may be taken account of in a number of ways, but in all of them it is clear that the sacrifices which have to be compensated include sacrifices on account of capital invested, and that this embraces depreciation, obsolescence, risk of loss, and interest on the entire investment; whether covered by bonds, stocks, or floating debt is an incidental matter.

7. THIRD PROBLEM—A CHANGE OF PRODUCTIVE METHODS

All that has been said about the economies of large-scale production applies equally to any proposed change in methods of production involving a change in the capital equipment, with one additional feature, namely, that a new method may involve scrapping some existing equipment prematurely as well as installing new. This complicates the estimate of capital costs, but at the same time makes some sort of estimate even more obviously necessary, since it is self-evident that operating expenses alone are only a part of the story.

To attempt to go into all the complexities of premature abandonment would be out of place here, as it presupposes a knowledge of the principles governing abandonment that is not premature—itself a rather large question. For the present we may start with the case in which the old equipment is ready to be scrapped and replaced in any event. Then it is clear that the new process must save enough in operating expenses to cover depreciation and interest on the extra investment involved; in other words, the excess of the cost of the new type of equipment above the cost of replacing the old. In order to justify scrapping the old equipment before the end of its natural term of life, instead of waiting, the saving would need to be larger, but just how much larger we cannot take time here to calculate.

However, the installation of the new plant need not bear the whole loss involved in writing off the value of the old, for one very decisive reason. The old plant loses its value, not because it is replaced, but because there is a new process which does the work better than the old plant can do it, and so makes it economical to replace it. This is equally true, whether the company recognizes the fact or not, whether it scraps the old equipment or persists in keeping it in service. If it is kept in service, its value is still its scrap value and nothing more. The act of scrapping the old plant and replacing it is merely a recognition of a loss already incurred.

8. FOURTH PROBLEM—INCOME AVAILABLE FOR DIVIDENDS

Those who have this problem to meet are the financial accountants, and if this were their only function, their definition of cost would probably be governed accordingly, and would include any and all obligations which must be met before dividends can be paid. These obligations include all operating expenses, depreciation, taxes, and all interest which the corporation definitely contracts to pay on either its floating or its funded debt. Dividends, however, are not a legal liability, and even in the case of preferred stocks they do not carry the power to put the corporation into bankruptcy if they are not met. On this basis interest on debts would be a "cost," but interest on investment represented by stocks would not be. From a broader standpoint, it represents sacrifices of production made by the stockholder, but for the purpose in hand this does not matter: what matters is that the corporation as such does not legally owe anyone this amount of money.

However, the books of the accountant are not used for this purpose alone. They are also frequently referred to as indexes of economy and efficiency, as records of the economic sacrifices involved in production. For this purpose, interest on debts, taken by itself, is clearly irrelevant. It would be absurd to suppose that one concern has heavy expenses because it has a large bonded debt and that another concern, with the same investment and operating expenses, has light expenses because its capitalization is all in the form of common stock. Cost means nothing as an index of the sacrifices of production when it includes items which depend, not on the total expenditure of resources in the course of producing goods, but merely on the form of financial arrangement under which the capital resources were raised.

Books whose primary purpose is to show how much income is available for dividends cannot easily be made to show as "expenses" all the sacrifices of production, and the only ones they can show on a basis that would be fair and comparable as between different concerns are the "operating expenses." Even these are ambiguous where an owner works for himself without salary, for here again the financial obligations of the industry fail to cover all the sacrifices made for the sake of the product. However, in most cases they are fairly comparable as far as they go. Accordingly it is natural that the income account should confine the term "cost" to operating expenses. Taxes and interest on bonds then become "deductions from income," and these, with operating expenses, together make up the sum of charges that are prior to dividends. This does not mean that "operating expenses" are the only expenses of production, but merely that they are the only ones of industrial significance which the income account can conveniently report consistently with its main purpose. This main purpose is financial and not industrial: the measuring of income available for dividends rather than the gauging of the economic efficiency of different processes or methods of production.

A company must have an income account, and it is foolish to quarrel with the forms which the accountant finds necessary and convenient for this purpose, so long as they do not set up to be more than they are, and are not forced to do duty for other purposes for which they are not adequate. We have seen that if we wish to decide whether to build a plant, how large to build it, or whether to instal new equipment, we must take account of interest on the entire equipment in question. If the financial accounts cannot conveniently do this, well and good, but that should not act as a veto on the inclusion of interest by the engineer or the cost accountant wherever their peculiar problems require it. There have been too many absolutes in accounting as in other arts and sciences, and an absolute generally means a conception which may be adapted to one purpose, but is arbitrarily used for other purposes which it does not fit.

9. FIFTH AND SIXTH PROBLEMS—DIFFERENTIAL COST OF ADDED OUTPUT

In cutting prices to secure additional business for a plant already built, we encounter cost in a new aspect. The cost attributable to the additional business is, strictly speaking, the difference between the cost of producing the larger output and the cost of producing the previous smaller output. This differential cost consists largely of an increase in the direct operating expenses, but it includes many other elements, even a trifle of interest on the increased working capital. Turning back to the table, we can see that 60 cars cost $51,120 more to produce than no cars, or $852 per car; 80 cars cost $10,180 more than sixty, or $509 per additional car; 100 cars cost $10,400 more than eighty or $520 per additional car, and 120 cars cost $24,940 more than 100, or $1,247 per additional car.

These "differential costs" are often the decisive thing in determining how cheaply the concern can afford to sell additional goods. They do not correspond with any possible accounting category. For the first sixty cars they are more than the direct operating expenses but less than total operating expenses; for the next forty they are a shade under the direct operating expenses and for the last twenty cars they exceed the average cost at full capacity, including all overhead charges. There is no percentage division of expenses into "constant" and "variable" which could possibly produce this set of answers. Nothing would furnish data for it except a study of the actual changes in total cost produced by changes in output.

If the additional output can be disposed of by "dumping" or in any other way which makes a separate class of it and leaves existing business absolutely unaffected, then the minimum limit below which the concern cannot afford to cut prices is simply the differential cost. Anything above this is a gain.

On the other hand, if the goods have to be sold all in the same market, by reducing the price to all customers, the case is not quite so simple. We may start with the assumption that the concern is marketing eighty cars at $1,100 each. This means that no interest is being earned, and little depreciation. Then if they were to cut the price to $900 in order to increase their output to full capacity, their gross income would be increased very little, only from $88,000 to $90,000, while their expenses would be increased by $10,400 and their total net income would be decreased by $8,400. Calculation will show that they must charge $984 on 100 cars in order to be as well off as they were before.

On the other hand, if they were previously selling the same eighty cars at $1,400, and reaping a profit of $9,000 above interest, the smallest price which they could afford to accept in order to push their output to 100 would be $1,224, otherwise their net earnings would be reduced. Or, thirdly, if they were selling eighty cars at $1,287 each, and just covering all of the interest charges, then the minimum price at which they could afford to sell their capacity output would be $1,134.

There are many special circumstances that would need to be taken into account, and which have not yet been touched upon. Three of these may be worth mentioning: first, the size of single orders; second, the question whether goods are sold immediately or whether a contract is made calling for deliveries well into the future; and third, the question what to do about materials which the concern has either bought or contracted to buy at a given price, in case the price changes, particularly if it goes down. Let us take these up in their order, taking, first, the question of many small sales versus a few large ones.

In the securing and filling of any given order, there are some costs which are virtually overhead costs for that order, although they may vary with the number of orders a firm secures and fills. In gas and electric light utilities there are some expenses which vary approximately with the number of customers served, regardless of size. These consist largely of accounting, bill collecting, and meter reading, together with interest and depreciation on the meter and on the minimum customer's connection. In a manufacturing plant such as we are studying here, there would be some selling expenses that would not vary with the size of the order a great deal of the accounting, the cost of planning and of making patterns or securing any other special equipment that might be needed. All this would make it possible systematically to quote slightly lower prices for large orders than for small ones, the discount depending on the importance of these items of cost which do not vary with the size of the order. From the standpoint of the business as a whole these may be strictly "variable" costs, they may, for example, vary exactly in proportion to the number of orders taken. But with reference to the size of the orders they are to be treated as constant items.

Secondly, what difference does it make how long ahead one takes orders binding him to deliver goods? The element of risk obviously varies. If one has already bought materials enough to fill all his contracts, then these contracts, calling for delivery at definite prices, reduce his risk rather than increase it. If, however, he has not yet bought his materials, a rise in price may cause him a loss and he is likely to find it wise to hedge against this loss if there is a speculative market on which he can make a hedging contract. Another element of uncertainty is the uncertainty of how busy the plant will be at any given time. On the whole, making contracts ahead tends to reduce this uncertainty if the product is something that can be made to stock, because the contract enables the concern to make more goods than they can sell in dull times, and still be sure of an ultimate market. In any case, the cost on which the manager is to calculate, then, is an indefinite, probable cost based on a fair estimate of what the conditions are likely to be. In such a case, the exact points on the curve of cost are not important and the difference between the cost of raising the output from 80 per cent to 90 per cent capacity, and rasing it from 90 per cent to 100 per cent capacity will not count. The important thing will be the general trend of the curve of cost. For such purposes a rough, rule-of-thumb formula may be the most useful thing, even if it is not exactly accurate.

With regard to material already bought, there is a possible conflict between accounting convenience and commercial fact. If a firm bought materials in advance and the price subsequently fell 50 per cent should the cost accountant use the actual cost or the present market value in figuring the cost of making these materials up into finished products? The principle involved is the same when a concern, without having actually bought materials in advance, has contracted to buy them at a fixed price. In reporting the finances of the concern, the actual cost of these materials is the cost which the firm actually incurred. Anything else, from that standpoint, would be a fiction. But with reference to filling an order which comes in after the price goes down, the cost of materials already bought is one of those matters of ancient history which has nothing to do with the question: What additional expenses are incurred as a result of filling this particular order? What the concern expends now is materials which it now has, not the money which it paid out for them some months ago, and the sacrifice now involved in putting these materials into a given order is really represented by what the concern could realize on these materials if it did not make them up and sell them to this particular customer. This sacrifice is measured by the market price of the materials and not by the original cost. The difference between the two is a loss due to holding goods whose price has fallen, and this loss should not be charged as a cost of making these materials into finished products.

A firm has been known to lose numbers of contracts because it kept on figuring its bids on the basis of the original cost of materials after the market price had fallen heavily. They were refusing to make bids low enough to secure the orders because these orders would not otherwise cover certain costs which they had incurred in the past. But such historical considerations have nothing to do with the question: What will our cost be next week if we take these orders, *compared to what they will be next week if we do not take them?* It is more convenient to charge materials at their original cost, but it is possible to charge them at the market price prevailing at the time they are used, and thus to separate gains and losses arising out of the producing of goods from gains and losses due to changes in the value of materials in stock. This is done by a number of concerns, and is certainly the more accurate practice. Wherever materials are charged at their original cost, the management needs to bear in mind the fact that the costs as thus reported are bygones and should be re-examined in the light of present market values if it appears likely that such a re-examination would give rise to a different decision in matters of price.

The problem of reducing prices in time of depression (the sixth in our series) is substantially the same as the problem of increased output worked backward. There is a difference, however, that is not shown in the table of figures. There are costs due to disturbance as such, and these furnish an added argument for cutting prices to retain existing business, while they work in the opposite direction when it is a question of expanding sales. Whether this item is large enough to be worth considering will depend on circumstances. In most cases it is probably negligible compared to other factors, known and unknown, which enter the problem.

10. SEVENTH PROBLEM—A TEMPORARY SHUTDOWN

This problem hinges on the fact that certain people would need to be kept on the pay-rolls as a nucleus around whom the organization could be built up again when production should be resumed. The backbone of the office and sales force would have to be kept and the key men in the other departments, while a certain amount of materials would have to be expended for repairs, and watchmen would be employed as before. In this case we have assumed that it costs $41,700 to turn out no output at all, and $51,120 more to turn out sixty cars, or $852 per car, so that it would pay the concern to cut prices down to that point, rather than to shut down entirely. The total income on this basis would not cover operating expenses, but it would come nearer covering them than if the income were nothing at all and the operating expenses of keeping the nucleus of the force together had to be met somehow. The corporation might be unable to finance such a policy and might go bankrupt, in which case a receiver would have the same problem facing him. In the ordinary case, however, if the emergency is a temporary one, the deficit can be met out of previous surpluses. The cost of keeping the nucleus of the force through a temporary shutdown is really chargeable against all the future business the firm expects to do after conditions improve and it becomes possible to reopen.

11. EIGHTH PROBLEM—A SIDE LINE

One way of keeping plant and personnel working steadily is to take on some side line which will help to fill in slack periods. In connection with any such side line there are two distinct questions. One is the cost involved in installing it and the income which it must show in order to justify the installation. The other is the cost of keeping it going after it is installed, and the two differ to the extent that specialized investment may have been made that cannot be redeemed to any other use. Since a side line of this sort is somewhat speculative and the special equipment needed for it cannot, in the nature of the case, be utilized very continuously, it stands the best chance of success if the special equipment needed is small. In deciding whether to undertake such a side line, the prospective income must be enough to cover interest, taxes, and depreciation on any special investment required, and these charges for the full life of the investment must be covered during the relatively limited time in which it is working. As for operating expenses, such a side line needs to be charged only with the difference in the budget which results from keeping the existing labor working on the side line rather than laying off all those who do not have to be kept as a nucleus in any case.

This last is itself an elastic quantity depending largely on judgment, and the existence of a side line which can utilize spare time may make it possible to keep on numbers of experienced workers who would else be laid off, and, in estimating the cost of producing the side-line product, the wages of such laborers do not properly count in full. It would be proper to deduct the cost of labor turnover which is avoided by keeping such men on the pay-rolls. *As a result the labor cost chargeable against such a side line would often be very slight.*

12. NINTH PROBLEM ABANDONMENT

By the time this problem comes up for settlement the concern is generally in the hands of a receiver, and he has to decide in the equitable interests of all concerned (but primarily the mortgage bondholders) whether it is worth while to go on operating the property. The crucial consideration here is what can be realized on the property if production is abandoned. The original cost is a bit of ancient history, but the plant must still earn something, or it will be better to scrap it. The land still has value, the materials and working capital can be realized on without much loss, the building may, with considerable wastage, be readapted to some other use, and the machinery can be sold at a scrap value. Let us assume that $70,000 can be realized in this way on the land and fixed equipment and $10,000 on the materials and working capital, or a total of $80,000.

If the concern is to go on operating there must be a prospect of yielding a return which would be worth, and would justify, $80,000 of investment sacrifice. Operating expenses, of course, must be covered. As for depreciation, nearly all the depreciation possible has already occurred. Perhaps the present salvage value of buildings and plant is $20,000 more than the ultimate scrap value would be if they were allowed to wear out in service. Depreciation on this would hardly be more than $800 per year, though it might be more if the remaining useful life of the plant were short. Interest would have to be earned at, say, 6 per cent on $80,000 or $4,800 per year, and taxes would have to be covered at whatever they could be scaled down to—perhaps $1,500 a year. This would give a total overhead (other than floating debt) of $7,100 in place of $23,400. This reduction of overhead would cut the necessary price from $1,300 to a trifle under $1,100, though perhaps something should be added for added risk in view of the bad record made so far. This $1,100 per car represents the cost of staying in business after having once set up a plant, while the $1,300 represents the total sacrifice involved in setting up the plant and operating it. If this total sacrifice cannot be covered, the appropriate thing is to scale the amount down to $1,100 and continue in business, if there is a reasonable prospect of selling a normal output at that price. This is considerably less than the average price necessary to justify the original investment, but it is a great deal more than is necessary to justify keeping the plant open for a short time if there is prospect of a recovery in business.

13. CONCLUSION

It is evident that in these nine different problems we have to deal with cost in different aspects and that no one formula for cost will fit all the cases. In the first case we dealt with the whole economic sacrifice of building a plant and operating it. In the second we dealt with the long-run added cost of added capacity. In the third case we did not change our output, but considered the cost of a new method of producing it. In the fourth we dealt with the financial expenses legally payable by the corporation. In the fifth, sixth, and seventh we dealt with the difference in cost attributable to a difference in business. In the eighth we dealt with a special case of this same problem, namely, the question of operation versus temporary shutdown, and we ended by studying the cost of continuing in business rather than going out of business permanently.

It turns out that cost in the first sense includes taxes, depreciation, and interest on the entire investment. Cost in the second sense is likely to be somewhat less, but is a matter of engineering estimate. Cost in the third sense includes interest, but cost in the fourth sense does not. Cost in cases five to eight includes much or little, according to conditions. The cost attributable to an additional unit of business is generally less than its pro rata share of operating expenses, but when it comes to pushing the plant beyond its designed capacity this differential cost rises until it exceeds a pro rata share of operating expenses and overhead costs together. Lastly, the cost of continuing in business, rather than going out permanently, includes interest on the salvage value of the investment and no more, and virtually no depreciation.

One slightly surprising thing is that we have two costs of producing the same output. The cost of producing sixty cars rather than none is $852 per car if the alternative is a temporary shutdown, or nearly $1,100 if the alternative is to go out of business permanently. But how can the cost of the same operation be different according to such an intangible test as whether the alternative is shutting down temporarily or permanently? Cost, it might seem, has to do with what is, and not with what might be.

The fact is that we are dealing with cost in at least two very different senses. There is cost in the absolute sense, of which case three offers one illustration. Cost in that sense is a present fact which cannot vary according to hypothetical alternatives. However, when one is making a decision of a financial sort, one needs to know the costs incurred as a result of making this particular decision; meaning costs which would not have been incurred otherwise. In other words, we have to deal here with what we may call "alternative costs." Every judgment on a matter of policy needs this kind of an estimate of cost if it is to be intelligently made.

Now, while accounting cannot be expected to report "alternative costs" in a finished state, cost accounting should furnish the raw materials from which the manager can make these comparisons. And this means, for one thing, that interest should be included in the raw data gathered by the cost accountants and should be used in various sorts of special studies of costs, whether it is regularly included in the officially reported costs or not. These special studies might be illustrated by the table we have already used showing how costs vary in response to changes of output. This clearly implies a careful study of costs for many weekly or monthly periods, an attempt to eliminate irrelevant causes of change, the selection of something which will serve as a unit of output, and a final conclusion as to the effect of output on costs, other things remaining equal. This is a very difficult analysis, involving some arbitrary quantities and much exercise of judgment, and therefore the story it tells, and, in particular, the figure representing the differential cost of added output, is an inference rather than a simple fact of record. But for that matter, whenever a cost accountant reports the cost of a particular job, including a share of indirect costs, the result is an inference rather than a simple fact of record. It is merely a different kind of an inference, and both kinds are valuable.

The peculiar value of estimates of differential cost lies in correcting certain natural errors into which a business man may be drawn by looking merely at total costs. He knows that costs are low when business is active and that he makes most of his money "on the peak," and he is likely to infer that the peak is a desirable thing and that costs at other times are higher. Yet the added cost resulting from added business is lowest when the plant is working at part capacity and when the plant reaches the point of lowest total cost per unit, the added cost due to added output has already risen enormously and will rise still more with every further increase of business. As a result, to sell five more cars, for instance, at $1,100 apiece might be a fine stroke of business when the plant is partly idle, a doubtful gain when it is working nearly full time and a positive loss when it is working overtime. This would be true without taking account of the further possibility that if the peak were cut off the investment could be made smaller without losing any of the off-peak business. If this were possible, then the differential cost of the peak business would be still heavier, for it would include part of the overhead charges that go on through the off-peak periods. So far, in our study, we have ignored this possibility, and justifiably so, since it would require something different from ordinary business tactics to refuse business at the peak without losing customers at off-peak times also. However, means might be found for overcoming this difficulty, and then the differential cost of the peak business would go up.

Thus the behavior of average costs does not tell the whole story, and "differential costs," conjectural though they be, are important to estimate.

CHAPTER X

WHAT IS A UNIT OF BUSINESS?

SUMMARY

Division of costs into periods, 204—Costs of different kinds of output, 206—A method of approximating differential cost for a variegated output, 208—Different dimensions of output, 210—The size of the unit of business, 213.

I. DIVISION OF COSTS INTO PERIODS

The assumption underlying a considerable part of the argument of the preceding chapter is that it is a good thing to know how much difference is made in costs by a difference in volume of business, or by a difference in methods of production, or by any other difference in commercial or industrial policy. Of course, if it would be of no use to know these things, then there is no use in wasting time studying how these differences in cost behave or trying to discover the best ways of estimating them. However, there is such a widespread awareness of the general facts of constant and variable expenses that business men are continually doing things which imply a knowledge of the manner in which costs vary, so that if they do not act on a correct understanding they will merely be acting on an incorrect one. Therefore the question arises: How near is it possible to come in an actual business to the ideal condition assumed in our fictitious case, in which we knew exactly what increase in costs a given increase in business was responsible for? Would it be practicable to construct a table showing these facts for an actual industry?

In the first place, the expenses would have to be divided into periods and charged against the goods produced in those periods. This problem has already had the benefit of much expert study, as it is one of the central problems of financial or general accounting. It presents a number of very real difficulties, because the money spent in a given week or month might not be solely on account of the output of that period, and the progress made in pushing goods toward completion might not be accurately measured by the amount of work actually finished and sold. Where the product takes some time to make, it would be necessary to resort to the device used in shipyards, reporting progress in terms of "percentage of completion,"[1] or some similar index.

Materials would of course have to be reported as a cost of production at the time they are used, rather than when they are bought. As for maintenance, it would be hard to make the figures mean anything for the purpose in hand. Maintenance expenditures for a given year ought to correspond roughly to the wear and tear which calls for maintenance expenditures and which results from the business of that year. But though these ought to correspond, too frequently they do not. Plants are allowed to run down, or permanent improvements are made and charged to maintenance. And for periods as short as a month there might be little or no connection between the wear and tear occurring and the actual expenditure for maintenance in that particular month or week. The very rush of work that jars bearings loose and wears down running parts may make it out of the question to stop the machine for repairs as long as it will run at all. Thus the repairs due to one week or month of heavy business may appear largely in the following week or month, while some of them may have been made in anticipation, and may appear in the preceding week or month. It is just possible that an able statistician might work out a formula for the distribution of the maintenance due to a given amount of work—so much in the same month, so much in the preceding and so much in the succeeding month which would fit the curves of actual costs convincingly and shed light on the question: How much effect does additional business have in increasing maintenance expenses? Even this would not prove that the expense was not concentrated in active periods because those were the times when the concern had funds available to spend, rather than because the need was peculiarly great in just those months. Some railroads divide their yearly budget of expenses for "maintenance of way and structures" into twelve equal parts and charge each month with an equal amount regardless of when the expenditures are made. Evidently they consider that the actual fluctuations are mostly due to irrelevant causes and would be more misleading than otherwise if reported month by month as made. Now if the actual fluctuations can tell no reliable story to a statistician it becomes necessary to fall back upon the next best thing, which is the judgment of the expert as to the amount of wear-and-tear which takes place. This would be only too fallible, but perhaps the best expedient at hand.

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[1] This device itself covers up a multitude of difficulties, for what is 10 per cent of a ship or of an automobile? What is the equivalent in keel plates of the caulking of 10 square yards of deck or the rigging of the foremast stays? An impossible question, yet there appears to be an answer which is true enough to be useful, whatever its logical shortcomings. Perhaps cost of keel plates, deck, or rigging material and installation would be an adequate common measure, though there would still be the indirect costs to allocate!

2. COSTS OF DIFFERENT KINDS OF OUTPUT

Another set of problems arises from the fact that virtually all concerns produce a mixed output, so that, no matter how much we study the variations of the total expenses, there will still remain the task of allocating them to different brands, qualities, and types of work. This task takes on so many different forms that it appears almost hopeless to generalize about it. There are the different seats in a theater—floor, boxes, and balconies. There are the different rooms in an office building or a hotel—inside and outside, upper and lower floors, etc., and different locations of floor space and window space in a department store. A machine shop turns out different kinds and sizes of machines, some in large quantities and some in small. And, as we have already seen, the larger machines are cheaper to produce per unit of capacity. A publisher turns out different kinds of books, in larger and smaller editions. A retailer sells goods with or without delivery, and for cash or for credit. Machines are sold with or without guaranties, and with or without costly services of demonstration and free repairs. Purchases are large or small and packages are large or small.

Even where a product can be reduced to units of some homogeneous quantity, there is often a perplexing variety of dimensions to choose from, for example, shipments, tons, and ton-miles in the case of freight, with further possible allowance for the dead weight of cars, which varies according to whether the cars are fully loaded and whether there is a return load or not. There is service at different hours of the day, different days of the week and different seasons of the year, all of which things may affect both value and cost, especially differential cost. Some goods almost sell themselves, while others require expensive selling services, some sell quickly and others more slowly. Some classes of telephone service require special speed, and this has to be given to all classes alike, both those to which it is essential and those to which it is merely an added convenience. In varied farming some branches are more or less complementary to each other and some are not, and farmers often have no clear idea which branches are profitable and which are burdens.

Evidently these cases are so different as to call for very varied treatment, and it would be out of the question to make one simple prescription to fit them all. There are, however, certain general methods out of which any system of analysis must be built.

In the first place, it is possible to divide the total expenses up, assigning every item to some product, or subdividing it and assigning shares to different products, so that all the costs are charged against different classes of product. But this tells us nothing about differential costs. Costs as allocated in this way could not possibly correspond with differential costs except in certain stages of output, and if we depend solely upon allocating expenses we shall never know what increased or decreased output really does to costs. Moreover, it is not easy for people trained in this sort of accounting, where the whole is necessarily equal to the sum of its parts, to take up the very different kind of analysis involved in a study of differential costs. For the sum of differential costs may be greater or less than the whole, sometimes by very large amounts; and the entire process of allocation must be freer and less conventional than the arithmetical addition of items which forms the backbone of accounting procedure.

On the other hand, if analysis were to depend solely upon watching the variation of costs, we should find the results quite baffling in a different way. If we could try unlimited experiments in the variation of costs, it would be found that the differential cost of product *A* depends partly upon the volume of product *A* turned out, and partly upon the volume of other products *B*, *C*, *D*, etc., turned out by the same plant. If the only evidence we could use to determine the differential costs of these different products were the actual variations of total cost, it would be necessary to get one series of observations covering different rates of output of product *A* while *B*, *C*, *D*, etc., remain constant; then a series of these series, representing different rates of output for product *B*, while *C*, *D*, etc., still remain constant; then a series of these series of series representing different volumes of *C*, and so on for as many products as the plant turns out. Fortunately, this impossible method is not necessary in order to get a useful idea of the variation of costs for plants turning out a varied output. It is possible to combine the method of allocating expenses with the method of observing variations, and secure useful results without prohibitive labor.

3. A METHOD OF APPROXIMATING DIFFERENTIAL COST FOR A VARIEGATED OUTPUT

In the first place, where the differential cost of *A* depends on the volume of *A* turned out, rather than on the general output of all products, this is clearly because there is certain equipment and perhaps certain skilled labor that is specialized to make this product, so that when it is only partly utilized there is waste and when it is pushed beyond its capacity costs rise.

But where this is the case any official would know it without being told by his cost accountants. Certainly it would not require an observation of series of series of statistical data to determine the fact. In the same way, where the differential cost of *A* depends upon the output of *B*, this may be for two reasons. They may be joint or complementary products in the strict sense or they may make use of some common equipment, such as cranes or a power plant, or the same skilled labor may work interchangeably on both kinds of product. Again, if this is true, any official would know it without needing a statistical investigation to inform him.

It would be possible, then, to divide the expenses into those specialized to product *A*, product *B*, etc., and those devoted to all the products or a considerable number of them, and then proceed to study how the specialized expenses vary in reponse to changes in their special products, and how the generalized expenses vary in response to the general changes in the volume of business. Since these generalized expenses are likely to have to do with some physically homogeneous thing like power, the question of a unit to measure the variations of utilization will frequently take care of itself in very simple fashion. Horse-power is not a unit of business, but for purposes of studying the effect of increased business on the general item of power, horse-power is the unit to use.

It would be possible, then, to report the cost of everything in a twofold way. First, the cost could be reported in regular accounting fashion, item by item. But beside every item would be another figure, representing the differential cost of the work, in the prevailing state of utilization of the general and special equipment and labor force. One way to arrive at this supplementary figure would be to study, for instance, the shape of the curve of cost for power as it varies in response to different rates of output. This would, of course, require a skilful survey-analysis based on the past experience of the plant for a considerable time, and of other plants also, if the records could be had. From this curve could be derived the percentages of differential cost per horse-power to average cost per horse-power, for each point on the curve. This percentage would usually be very small for a plant working at a small part of its capacity, and might rise above 100 per cent when the plant is being pushed hard, especially when there is overtime to be paid for at extra rates. Suppose that it is 25 per cent when the power plant is working at 60 per cent of capacity. Then a piece of work, done when the plant is working at that rate, and charged with $10.00 as its full share of the cost of power, would be rated at $2.50 as its differential cost for power. Treating all other items in the same way, one would have a figure for the differential cost of that particular job, and could guide his decisions accordingly.

Of course, it would be expensive to report the cost of every item of output in this dual fashion, and probably the same result would be attained by doing it only now and then: sampling the run of the business whenever the management might feel in need of the information. The underlying survey of curves of cost and utilization, once made, would have to serve a considerable time in order to justify itself. A small plant could not afford to make such a survey at all, but in such a case the industry as a whole would generally find it worth while to have a survey made for the benefit of all alike. Wages and costs of materials might change but these changes would not greatly affect the percentages of differential cost to average cost, so that these could be used for a considerable time.

This is, of course, only one possible suggestion. The results of a cost survey might indicate that some simpler approximation would be close enough to serve all practical purposes. For example, in the hypothetical case discussed in the preceding chapter, differential cost is almost identical with direct operating expenses per unit, except at the upper and lower ends of the curve. In such a case one might simply take for granted, within proper limits, that direct operating expenses are a measure of differential cost. This would be very different from taking the same thing for granted without any cost survey to tell if it approached the truth, and without any regard to the limits within which it might be true.

4. DIFFERENT DIMENSIONS OF OUTPUT

For certain purposes managers would wish to know the long-run additional cost of increased output where additional equipment would be required to handle it. This would require a different sort of survey based if possible on the experience of many plants, and, if that is not to be had, on engineering estimates.

For such purposes, and for some others, it may be found convenient to reduce all varieties of output to some arbitrary unit, but it goes without saying that all such units must be used with the greatest caution. In the case of railroads the ton-mile is quite an arbitrary unit for freight, good only for comparisons that involve no marked change in the make-up of the traffic—no large increase in package freight and falling-off of coal, or vice versa. As for passengers, they are frequently merged with freight in a composite unit or "equivalent ton-mile," consisting of one ton-mile of freight *or* some specified fraction of a passenger-mile. For instance, Dr. M. O. Lorenz, statistician of the Interstate Commerce Commission, has made a calculation in which every passenger-mile counts as the equivalent of 3.67 ton-miles. This particular figure was selected because then the revenue per "equivalent ton-mile" would be about the same as the revenue per ton-mile of freight.[1] The unit really is, then, a ton-mile of freight or an amount of passenger-travel that yields as much revenue. In this sense, it is a unit of earnings. Sometimes a unit of cost is chosen instead, though this obviously presupposes that the roads have already made an accounting separation of the costs of freight and passenger business.

Whenever such a separation is made, it must needs be on the basis of certain physical or financial dimensions of the business which are presumably the best index of its responsibility for each particular class of costs. For example, there is the ton-mile of paying freight, the simplest unit of volume of traffic, but so simple that it does not express the dimensions that directly control any of the important classes of costs. Then there is the ton of paying freight, the best simple index of responsibility for the services of loading and unloading. This, of course, would be used in this way only for less-than-carload freight, since carload freight is loaded and unloaded by the shipper. Then there are the number of gross ton-miles (train and contents) for which a given group of shipments is responsible, the number of train-miles, the number of locomotive-miles and the number of locomotive-ton-miles. The gross ton-mile is a fair index of haulage costs, though if it is a question of improving the roadbed so that the same locomotives can haul more cars, haulage cost per train mile will probably remain nearly constant and the increase will take place in maintenance and interest on way and structures.[1] This, however, is a special case, calling for a special analysis by engineers rather than accountants.

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[1] M. O. Lorenz, *Railway Age* (March 24, 1923), p. 799. For a criticism of the traffic unit see *Railway Age* (February 24, 1923), pp. 463-66.

It would be physically possible to report all these dimensions for every shipment, but the cost would be prohibitive. Railroad operating men have quite enough entries to make as it is. If all this were done, the shipment could be charged with whatever part of the total terminal expense corresponds to its net tonnage, whatever part of maintenance of way corresponds to the gross ton-mileage represented by this shipment, and so on. The result would be a figure which might purport to be the "cost" of that particular shipment. Though such things as the terminal cost of handling unduly large or small packages would still remain to be allowed for, this could be done by an extension of the plan, after a rough-and-ready fashion.

Such a figure, however, would be of little use to a railroad. A shipment of five tons of soap taken Thursday might "cost" twice as much as an identically similar shipment taken Saturday, for reasons that were wholly accidental. The road, however, must move the soap when it is offered and on the same terms to all shippers. They are not interested in accidental variations in the cost of particular shipments. So far as these represent wastes to be minimized, they will appear in operating records of a more general type, recording, for instance, the efficiency of train movements without attempting to apportion costs to particular shipments. What the managers might reasonably wish to know is the cost of all the less-than-carload traffic in soap, and in other commodities that move in similar packages and volumes and to and from similar classes of terminals. The records of this shipment, or of the train movement that carries it, or of the terminals through which it has passed, ought between them to contain raw material from which such a general analysis could be made, but these records need not all be borne on the back of each single shipment as it moves from origin to destination. In this general analysis it would be known about how many net tons, gross ton-miles, etc., are chargeable to this traffic, and it should be possible to estimate both the average cost and the differential cost of that many tons handled at given terminals, or of that many gross ton-miles moved over the line under fairly representative conditions. Even a few sample studies of this sort could yield quite valuable information.

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[1] The best formula for train resistance is in the form: "So much per car plus so much per gross ton."

5. THE SIZE OF THE UNIT OF BUSINESS

This leads us to another principle under the general question, "What is a unit of business?" namely, that costs need not be divided and traced to smaller units of business than are involved in decisions actually made, rates actually fixed, precedents actually determined, etc. The most important unit is a single business decision, and whatever volume of business may be governed by it. The single shipment of five tons of soap is not a business unit in this sense, because nowadays no one ever makes a special rate for that much traffic, or initiates any special production policy on its account. The smallest unit that could be considered is the entire traffic from, say, Zenith to Gopher Prairie in soap and any other articles taking the same rate, from the time the rate is fixed for as long into the future, virtually, as the underlying economic conditions shall continue without considerable change. For many purposes the unit would, in fact, be far larger. In the largest rate cases the attempt is usually made to maintain intact the existing adjustments between places and commodities, so far as possible, though question may be raised as to rates in one section of the country relative to another, or rates on coal or some other major commodity as compared to the general level of other rates. Under such circumstances the question of differential cost hardly arises at all, the units are so large they amount almost to the whole traffic of the road, and it is taken for granted that classes of such magnitude should bear their fair share of all overhead burdens.

Another type of decision arises out of such proposals as that for seasonal rates on coal. Here the principal unit in question is the traffic in coal in the spring when traffic is regularly lighter than in the fall. There is no clear reason why this traffic should bear its pro rata share of overhead costs as compared to traffic moved during the regular October peak. In fact, there is every reason to the contrary, and the decision on this question might very well hinge on the differential cost of additional off-season business.

Even where a traffic official is apparently considering a rate involving a very small volume of traffic, this appearance may be deceptive, because what he does in this case will almost surely serve as a precedent for many similar cases, or is itself modeled after some such precedent, or is a part of a general policy according to which cases of this class are settled.

One can imagine the situation of the old-time traffic official, in the days before the anti-rebate laws, when he was approached by shippers each of whom wanted a special rate. If he set his minimum at the costs he could trace to each shipper's business, it would frequently be next to nothing. A few carloads a month have almost no traceable cost, and might be a gain at almost any rate. But let a hundred shippers use the same argument and get the same response, and there are several extra trains a week and a need for more rolling stock; let a thousand do it and there are several extra trains a day, and there will have to be new rolling stock, new terminals, and perhaps a rebuilding of the main line. So if the road carries one man's traffic at a low rate because its traceable costs are next to nothing it may be setting a precedent which will result in a total volume of traffic costing far more than the rate made.[1] American railroads have undoubtedly fallen into this trap on occasions, and perhaps habitually.

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[1] Hadley's classic oyster case rests for its justification on the fact that a low rate would bring in just half a carload of business to fill a half-empty car, *and no more*. This means that it is not typical, because the typical thing is growth, with many interruptions, many fluctuations, and no definable limit.

Thus every traffic decision should be treated as a possible precedent, and the wise road will avoid setting precedents which may become unprofitable by reason of coming to apply to an increasing volume of business. A road should not ask whether John Doe's business more than pays the costs visibly traceable to it, but whether the low-grade traffic as a whole, or the rebate traffic as a whole (in the days of rebates) were worth the cost fairly chargeable to it; usually including a reasonable share of all the "constant costs," not omitting interest on investment. For practical purposes, then, the important differential unit of traffic is almost always a large one. Therefore (to return to our theme) if the analysis of costs is detailed enough to show the differential costs of these large classes of traffic, it is sufficient for all requirements. Something similar is true, in differing degree, of most other businesses which are above the personal-bargain stage of development. Unlike the mathematician, the business man seldom concerns himself with infinitesimals—never except as incidents in a policy that he deems important. And the economist can fairly follow his example.

CHAPTER XI

THREE METHODS OF ALLOCATING COSTS

SUMMARY

The three methods defined, 216—The accounting method, 218—The statistical method, 223—The method of operator's estimate, 227—Conclusion, 231.

I. THE THREE METHODS DEFINED

There appear to be three main methods used in dividing up the costs of a given concern so as to be able to specify the cost of particular items of output. Perhaps, instead of methods, these should be called elements of method, because any adequate method of tracing costs must necessarily use more than one of these elementary methods in order to secure useful results. These three elements, then, may be called the accounting method, the statistical method, and the method of operator's estimate or engineer's estimate, with the proviso that these "methods" do not stand alone. A system of cost accounting cannot be constructed without using the method of operator's estimate in determining the basis on which to allocate indirect costs, and a statistical analysis can hardly be carried out without presupposing some use of the accounting method in classifying the data which the statistician uses. What these terms mean, then, is that certain processes are most prominent and most characteristic in the work of the accountant and others in the work of the statistician or of the expert operator or engineer.

By the accounting method is meant the system which grows out of taking the individual entries of cost (originally gathered for purposes of the income account and the balance sheet) and charging them against particular items of product. Some can be charged directly, because the materials or services they represent are physically identified with some unit of product in a visible and unmistakable fashion. This is not always quite the same as saying that these expenses are economically caused by these items of product, as we shall see later, but it is an evidence of one kind of causation, and it is the kind which the methods of accounting are capable of recording. When it comes to expenses which cannot be identified with units of product in this direct fashion, accounting tends to do the thing most nearly similar—which may or may not be the next best thing—and allocates these "indirect expenses" to one or the other department, process, or commodity on some predetermined basis. Either of these methods retains one dominant characteristic of the system of general accounting of which they are an offshoot. Costs are built up by a process of arithmetical addition, and the whole is equal to the sum of its parts. There is one qualification, with which we shall have to deal later, which may be described by saying that some of the costs are allocated as costs of idleness rather than costs of production. Even here, however, the system is so managed that the totals will balance.

Very different from this is the characteristic method of statistical analysis. It is not merely a different method; it yields a different kind of information. This method involves observing differences in cost which correspond to differences in the volume or character of the output. This study may cover the total costs of the business as a whole, or the costs of one department, one process, or one commodity or class of output. For this purpose one observation means nothing, and to make the method at all scientific a large number of observations are required. For instance, a concern may watch the monthly fluctuations of its expenses and compare them with the fluctuations of output, in order to learn what the differential cost of added output is. Or it may be possible to compare the costs of different establishments some of which are integrated and others of which are not (for example, sugar factories which buy their beets and factories which raise their own) in order to see how the costs of the two methods compare with each other.

Different from either of these is the method of operator's estimate. This is exemplified in many discussions of railroad costs, where it is asserted that two-thirds, let us say, of the expenses for maintenance of way are independent of traffic, and that half of the expenses of conducting transportation are independent of traffic. Just what process is involved here is not always easy to say, but it is clear that it is something different from the formal analysis of the statistician or the arithmetical ritual of the accountant. Perhaps it is an intuitive short-cut which may involve an implied or unconscious calculation of either the statistical or the accounting variety, or a combination of both.

Each of these three methods has both its strong points and its limitations. And they need to be used to supplement each other in any thoroughgoing analysis of cost. Let us first look at the outstanding features of the accounting method.

2. THE ACCOUNTING METHOD

In its origin, accounting is not essentially a method of allocating costs to goods, but rather of recording them so as to secure correct totals, and to make it possible to identify the transactions out of which any part of this total outlay arose. The tracing of causal responsibility in an economic sense is a more involved matter. However, there is one kind of allocation which cannot be escaped and is presupposed in any system of accounting records, namely, allocating expenses and income to a given period of time. Without this, an income account or a balance sheet means nothing. Further, where a business is organized by departments, it is useful to allocate expenses to these departments, as a help to locating efficiency or waste. For the same purpose it is very desirable to isolate the expenses of different processes carried on within a given department. When analysis reaches this point, it deserves the name of cost accounting, and diverges from general accounting, while the tracing of costs to units of product is, if anything, even more specialized and differentiated. It is a collateral branch of accounting, going into causal analysis as general accounting does not, and yet based on the technique of the parent stem. It is still cast in the general mold of arithmetical addition of constituent items, and in form, if not in essence, the whole is required to equal the sum of its parts.

One of the strongest points of this method is that it deals with the observed facts of the particular case in hand. Another advantage is that where the sum of the costs of the individual items of product equals the whole cost incurred by the establishment, the individual "costs" can be used for purposes of fixing prices, with a fair degree of confidence as to the ultimate effect on profits. Furthermore, if anything happens to change the cost, the accounts will show it promptly, without waiting for the results of elaborate statistical studies.

We have seen that there are two kinds of accounting allocation, one for direct costs and the other for indirect costs. The direct costs are such costs as the materials which go into a particular finished product and the labor that is actually spent in working up those particular materials, and no others, into that particular product, and no other. A certain amount of leather goes into a pair of shoes directly, and a worker spends a certain amount of time in the process of sewing together the soles and uppers of that particular pair of shoes. Anyone who watches the process can see that this labor and these materials are physically devoted to that product and no other. On the other hand, the laborer works with a machine which draws its power from a shaft to which other machines are also coupled, and the ultimate source of the power is a central plant which makes power for all the processes in the factory. No one, by merely watching the process, can tell how much of the cost of the central power station or of watchmen, cleaners, janitors, or legal counsel should be charged as the cost of each pair of shoes turned out. These are indirect costs, and have to be assigned or allotted on some basis other than direct observation.

This allotting of indirect expenses is a different kind of process from that of charging the direct expenses to the product into which they go. It involves something more than the mere recording and adding up of items. It really involves the method of operator's estimate or expert judgment, and it is something which can frequently be helped out and made more accurate by the aid of statistics. It involves a judgment as to what causes govern the amount of the indirect expenses. For instance, in an electrical power station the interest on the investment in the company's central fixed plant does not depend on average output or total output but does depend on the capacity of the plant, and this in turn is governed chiefly by the maximum demand which the plant must stand ready to meet at any time. This expense, if it is to be treated as an expense at all, belongs in that group of expenses whose amount is governed by the capacity of the plant, and varies with the capacity. These are called "capacity costs." They cannot fairly be allocated to all customers alike at so much per kilowatt hour, because some kilowatt hours bear a heavy responsibility for taxing the capacity of the plant, and others bear none at all.

So a careful system of accounting would find some measure of the consumer's responsibility for increasing the maximum demand which the concern must stand ready to meet, and having found such a measure it would allocate the "capacity costs" to each customer on the basis of the measure of his "peak responsibility" which has been adopted. Such a system would naturally still stick to the fundamental characteristic of accounts: namely, every expense would be allocated somewhere, so that the whole would equal the sum of its parts. These measures of responsibility for the indirect expenses are necessarily rather imperfect things. In some cases, they may be quite arbitrary. The difficulty of assigning such an item as interest on the fixed investment may furnish one reason why accountants so often prefer to exclude interest from costs entirely, but it is just as hard to allocate depreciation and maintenance, so that this particular difficulty is not removed by eliminating interest.

One of the unfortunate features of the accounting method of analyzing costs lies in the tendency to confuse "fixed charges" with "constant costs," or to assume that fixed charges are necessarily constant costs, so far as they are treated as costs at all. This question has already been discussed (chap. ii) and exemplified (chap. ix) so that it need not be reiterated that "fixed charges" are a matter of the financial obligations of the company, but do not tell how its essential costs of production actually behave. As we have seen, with reference to short-run fluctuations of output, constant costs are typically much more than the "fixed charges," while with reference to long-run growth of business and plant, there are virtually no constant costs. Capital outlay increases, whether "fixed charges" rise or not, and while the increase in investment is extremely likely to carry with it a harmonious increase in the portion covered by bonded indebtedness, this need not happen; and if it does, the increase in fixed charges is an incidental and nonessential accompaniment to the essential fact of an increase in the sacrifices of production, owing to an increase in the capital resources devoted to that purpose.

This sacrifice is simply impossible to ignore, in any intelligent comparison of costs, since it is one of the things which makes some commodities more expensive to produce than others or some processes of production more economical than other processes. The accountant who refuses to admit that interest is a cost does not, therefore, judge that every labor-saving device is worth installing, regardless of the investment involved: he merely translates his inquiry into another form, asking whether the saving is a fair return on the investment. As between goods requiring much capital and goods requiring little, he asks which yields the largest return on the investment concerned. But in order to answer this question it is first necessary to allocate the investment, charging a definite amount of capital outlay against a particular process or a particular commodity.

Thus the necessity of allocating responsibility for capital expenditures is not avoided by refusing to treat interest as a cost. There is, however, one thing gained. The allocating of responsibility for investment is no longer a matter of accounting—a part of the regular procedure of keeping the books—but is a broader matter of the study, analysis, and interpretation of the accounts and operating records. This frees it, or ought to free it, from the trammels of accounting ritual, so that it should be possible to treat the matter in any way which any particular problem may require.

There is one thing which the accounting method will never tell, and that is whether an increase in the volume of business will involve a proportionate increase in the indirect expenses, or less, or more. Accounting allocation, when it selects an index of responsibility for indirect expenses, virtually takes for granted that these expenses vary in exact proportion to the variations of this index, whatever it may be. This is usually not the case, and therefore the accounting allocation tells no true story of the differential costs occasioned by any particular additional amount of business. This requires a different technique altogether.

Nevertheless, the uses of the accounting system are obvious and quite indispensable. It tells the management how its costs are behaving, and if there is a suspicious increase in the costs, which may be a symptom of a loss of efficiency somewhere, the management has the figures recorded in sufficient detail to make it possible to tell in what department the increase occurred, whether it was in materials or labor, and in what step of the process it occurred, or whose machine it was which took an unusual amount of time in the completion of the given job. The management is accustomed to guide its financial and technical policies according to its costs, among other things, and whatever methods it uses, right or wrong, logical or illogical, have at least stood the test of experience; and in any case, a knowledge of what has actually happened is the necessary basis for all intelligent judgment. However, this will not of itself tell the manager what his costs will be next week or next month if he follows a given policy, and for many purposes he needs to be able to prophesy in this fashion. This the accounts, taken by themselves, will not enable him to do.

However, the accounts themselves involve some prophecy. Depreciation is essentially a prophetic item. It represents an estimate of the present reduction in value of the plant, due to the fact that it has fewer years of usefulness ahead of it, and probably years of diminished uesfulness compared to the years when it was new. This is essentially a prediction, based on past experience, and in order to be at all scientific it needs to be based upon a thorough statistical study of the life-history of similar kinds of machinery and equipment. Thus it appears that accounting involves, at certain stages in the calculation and allocation of indirect expenses, both the method of operator's estimate and, if it is adequate, the method of statistical analysis.

3. THE STATISTICAL METHOD

Next let us look at the statistical method and see what its strong and weak points are. Its advantages and disadvantages both center largely around the fact that it studies the behavior of total expenses and records whatever it finds. This is an advantage, because it will do the one thing which accounting is least able to do, namely, discover whether the differential cost of additional business is more or less than the average, and discover it by studying the actual effects of increased business, not by mere conjecture or expert estimate.

The statistical method furnishes the only valuable evidence as to how the "constant costs" really behave. And it is adaptable; it can sample the data in different ways and make different tests, throwing light on different kinds of cases. It can study fluctuations of any duration: day-to-day, month-to-month, or year-to-year; or it can study the long-run economies of large-scale production, comparing plants of different size, each of which is adjusted to its characteristic range of output. And a statistician would not be disturbed if each of these tests gave a different answer and revealed a different amount of residual cost in each case, even in the same industry. The table on page 185 is an example of hypothetically simplified statistics and indicates how this method is capable of showing a differential cost which is high in one case and low in another. A little later, in studying railroad costs, we shall see how the actual figures may tell one story for short-run fluctuations and a very different story for long-run adjustments. And in each case the data make it perfectly unmistakable what kind of a case is being tested, so that there is no excuse for applying the results of a study of week-to-week changes to a decision involving a permanent increase in business, or vice versa. Accounting formulas have not this discrimination, and the dicta of expert judgment are too frequently presented as universal rules without specifying their limitations, and what kinds of cases they apply to.

The statistical method has a further advantage in that it catches everything which expert judgment might overlook, and corrects automatically any possible fallacies due to semi-intuitive methods of arriving at conclusions. If the expert concludes that half the costs are constant and half variable, he may be overlooking the fact that additional business will call for additional equipment, or he may be overlooking some economies in the "variable" expenses of operation. If the "constant costs" increase, statistics will show the increase inexorably. They will not overlook anything.

In this last fact lies also a disadvantage, for the statistical records catch too much. They show the effects of everything that has happened, not merely the effects of the things we wish to study but the effects of a multitude of other things which are entirely accidental or irrelevant to our particular purposes. If we wish to know the effect of increased business on costs, and study the changes from month to month with this in view, the figures will show all the effects traceable to changes in business, but they will also show the increased cost of a strike, of heating the buildings through a severe cold snap, of an attack of spring fever, or of an accident due to some employee's over-indulgence in home-brew. If we wish to discover the effect of increased traffic on railroad expenses, and for that purpose compare a series of railroads, or a series of divisions, some with light traffic and some with heavy, the figures will show the whole effect of increased traffic on the expenses, including all the items which an expert might overlook; but they will also show the effect of many other things. One road is located on the plains and another in the mountains, one road has to encounter blizzards while another is in a warmer climate, one road has a well-balanced traffic with nearly equal amounts of east-bound and west-bound tonnage, while another road must haul a large percentage of empty cars, one road has traffic which is very steady throughout the year, while another has to provide for heavy seasonal fluctuations. In fact, there is no end to the irrelevant circumstances which insist upon recording themselves.

Two main kinds of comparisons are possible: successive observations of the same business unit and simultaneous observations of different business units; and each one has its own difficulties and is complicated by its own peculiar kind of disturbing elements, as the foregoing illustrations show. If we study the trend of costs from year to year, it becomes necessary to allow for changes in prices and wages, for improvements in technical methods of production (which may reduce expenses in ways that have nothing to do with the increase in volume of business), and other things. These create difficulties, no matter what it is the statistician is trying to study. If he is trying to study the effect of unbalanced traffic, changes in the total volumes of business will be a disturbing element, while if he is studying the effects of increased volume of business, changes in the proportion of east-bound to west-bound tonnage will be irrelevant to his purpose.

He can escape some of these disturbances if he shortens his period and studies costs of successive months or successive weeks, but here a new difficulty arises. For it is hard to determine just what costs incurred in a given week are due to the business of that particular week. As we have already seen, maintenance expenses may vary from week to week or from month to month without much regard to the wear and tear which the business of each week or each month occasions. Therefore, before a statistical study can do anything with weekly or monthly figures, the accountant must have made a careful allocation in order to make sure that the costs reported for a given week really belong there.

Fortunately, this is one of the oldest and most fundamental questions with which the general accountant has had to deal, so that he has developed methods of meeting this difficulty. Before preparing his balance sheet he has to determine what costs are properly chargeable against the business of the accounting period which has just closed. However, a balance sheet is not prepared every month or every week, and the accounts do not automatically charge against each week precisely those costs occasioned by that week's business. Hence this kind of study may require some special preparatory work on the part of the accountants. More particularly when the period is as short as a week, the results would come to depend too much on the accountants' judgment as to what expenses were properly chargeable against the business of that particular week, and also upon his judgment as to what production should be credited to that particular week's activities. The amount of unfinished work on hand may vary considerably, so that it is not a simple matter to decide what the output of that particular week is. For all these reasons the shortening of the period of study sacrifices some of the peculiar benefits resulting from the statistical method, and very short periods are extremely unreliable for statistical study.

One question before which the statistical method by itself is very nearly useless is the question of the relative cost of different types of output. It can tell the cost of a 2 per cent increase of business, or a 5 per cent increase, but its measure of volume of business is likely to be crude. If it is an automobile factory, the natural measure is the number of cars turned out, but it is not easy to allow for the difference between a roadster and a sedan, and a considerable change in the proportion of cheaper to more expensive cars might render the figures quite unreliable for purposes of pure statistics.

It would be possible to attack the problem of the relative cost of roadsters and sedans by unaided statistical analysis. Or this method might be used to separate the costs of passengers and freight.[1] The expenses of different divisions could be correlated with differences in the proportions of passengers and freight, and a conclusion arrived at as to the relative cost of freight and passengers. For this purpose there must be enough observations so that irrelevant factors are eliminated by force of numbers. Curiously enough, the very thing which was the main object of study a moment ago—the effect of volume of traffic—is now an irrelevant circumstance, and what was then an irrelevant circumstance is now the main object of study. The same figures might be used for both purposes, and, if there were enough observations, they might tell a credible story in both cases.

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[1] The writer has seen a statement, which he cannot at the moment verify, that this has been done by the German railroad economist, W. Launhardt.

But the method is awkward, at best, and it is hard to disentangle the disturbing causes sufficiently well to make it convincing. And if one were to try to separate the costs of different classes of freight in this way, the attempt would break down of its own complexity. In general, other methods must be relied upon for separating the costs of different types and classes of output from each other. This will usually mean allocating all the costs, with the result, as we have seen, that no recognition is given to the reduced cost of increased output. But after this has been done, if the concern wants to know how much or how little effect additional output has on costs, a statistical analysis may come to the rescue by showing that differential cost in this business, under the given conditions, is equal to about half the average cost, or nine-tenths, or what not. Such a supplementary study could only speak in approximate terms, but an approximation is far better than nothing.

To sum up: The statistical method works under enormous handicaps, and yet there are certain things which cannot be revealed in any other way and therefore, faulty as it is, it is an absolutely indispensable aid to any really comprehensive analysis of cost. It is the only method which can give even moderately unprejudiced information about differential costs.

4. THE METHOD OF OPERATOR'S ESTIMATE

Finally, let us look at the method of operator's estimate. This takes various forms and we shall need to examine several types. One excellent example is a study made by Mr. Nimmons, a Chicago architect, for the purpose of determining the most economical height for an office building in the central business district of Chicago. Selecting a given lot he built upon it, on paper, six different buildings of heights ranging from five stories up to thirty, estimating the total cost of each structure, the cost of operating it and maintaining it, and the amount of office space available. This might be called hypothetical statistics, but it differs from statistics in not being forced to cover a multitude of cases and to include masses of irrelevant data in order to sift out the trend of one force. Everything irrelevant is eliminated, and the result is what the experimental scientists would call a "controlled experiment"—on paper. The method is really the method of hypothetical experiment. It has the advantage of eliminating the disturbances to which actual statistics are subject, and the disadvantage that its oversights are not automatically checked up by the test of actual experience.

Another form of operator's estimate is the one already mentioned: the familiar estimate of what percentage of the expenses of a railroad are constant and what percentage are variable. Just what this means to the person who makes the estimate requires a certain amount of imagination to determine, for so far as the literal meaning of words goes, the proposition that two-thirds of the expenses of a railroad are constant is quite ambiguous. How is it mathematically possible for two-thirds of the expenses to remain constant and still remain two-thirds of the whole, if the rest of the expenses vary? Or for one-third to vary and still remain one-third, if the rest remain constant?

For instance, in one case Ripley applies this formula to a tenfold increase in traffic (a magnitude far beyond its proper range) and concludes from it that, if the original costs were 100, the cost of carrying ten times as much traffic would be $66\frac{2}{3}$ (the constant component) plus $10 \times 33\frac{1}{3}$ (the variable component) or 400 in all.[1] By the time total expenses reach 400, the constant costs, if they really stayed at $66\frac{2}{3}$ (which they could not do) would be only one-sixth of the whole, instead of two-thirds. Yet Ripley points out elsewhere that constant costs maintain a surprisingly steady ratio to variable, as the totals increase from year to year. How explain this paradox? The answer is that, when the plant has a given capacity, short-run fluctuations of moderate amount, within the limits of that capacity, will cause expenses to vary about one-third as much as traffic; while capital investment and many other elements of cost will not change at all.

This clearly takes for granted that the road has not only trackage enough to handle any amount of traffic which may be

[1] Ripley, *Railroads: Rates and Regulation*, pp. 71–73.

considered, but cars enough also. Now a road might have tracks capable of handling far more traffic than existed, simply because it could not have less than a standard-gauge single-track line. But if it had cars enough for twice the traffic, even in time of depression, the management would be suspected of reckless extravagance, if nothing worse. Cars can be built as they are needed, and a permanent growth of traffic ought to require the building of more cars, the lengthening of sidings, enlarging of station buildings, and other additions to the plant, so that plant and operating expenses would grow more or less in proportion to each other. Would they grow as fast as traffic or would there still be some economy? On that question the formula is silent. At any rate, after the plant has expanded to meet the needs of traffic, the enlarged plant investment will remain unaffected by small, short ups and downs of traffic, within the overload capacity of the enlarged plant. In other words, this formula applies only to fluctuations of a certain range and period, but it does not state what range or what period, and therefore it is decidedly ambiguous.

This defect could be remedied. Instead of merely saying that a certain part of the expenses are "constant," care should always be taken to say that a certain part of the expenses are unaffected by such-and-such a change in volume of business. For instance, take an increase of business which can be handled by increasing the trainload without necessitating the use of more powerful locomotives. This would leave most of the train-movement expenses unaffected, though it would increase fuel consumption moderately, and would call for more rolling stock unless it were a short-time increase, confined to an off-peak season. On the other hand, an increase which requires an increased number of trains will call for more locomotives as well as more cars, unless it is confined to an off-peak season, and will in any case increase the train-crew expenses about in proportion to the increase in traffic.

Another instance may help to show the need of being specific as to what kind of an increase in business the propounder of any cost formula has in mind. In one case Ripley assumes that the replacing of ties is due chiefly to weather rather than to use, and therefore concludes that it is independent of the volume of business.[1] But does this conclusion follow? Grant that the deterioration is due wholly to weather, but suppose also that *amount of plant exposed to the weather* varies with the traffic, in the sense that larger traffic requires the road to use more cars and lay more tracks in yards and sidings, and therefore to have more of them suffering the wear and tear which the elements impose. Then this item of cost, which is entirely due to weather, is also affected by the volume of business and is, in part at least, economically traceable to traffic. The difficulty here is chiefly due to a failure to be explicit as to just what kind of a change in traffic the maker of the estimate had in mind.

In this particular case, it is fair to suppose that he had in mind such short-run fluctuations of traffic that it would not be possible to increase or decrease the investment in rolling stock or structures, and therefore the only effect that increased traffic could have would be to make the existing equipment deteriorate more rapidly. The statement is probably quite correct with reference to this particular set of conditions, but it is capable of being misunderstood and misapplied because it does not state clearly just what kind of conditions it was meant to cover. For instance, when Professor Ripley himself later uses this formula to calculate the effect of a tenfold increase in traffic,[2] he is, as we have just seen, ignoring the fact that no railroad management in its senses would furnish cars enough for ten times the existing traffic, and unless they did, they could not handle the increase without getting more cars, and therefore paying more for the repairs which are, in one sense, due solely to weather.

So far as the general statistics furnish any evidence, they serve to indicate that, over a term of years, rolling stock has increased about as much as traffic, measured not in number of cars and locomotives, but in terms of tonnage capacity and tractive effort.[1] This illustrates the great advantage of the statistical method, in that it is nearly always evident from the data themselves just what sort of a case they apply to. In this matter the method of operator's estimate is likely to be ambiguous unless special care is taken to be specific.

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[1] Ripley, *op. cit.*, pp. 51–52. Ripley does not ignore these facts; on the contrary, he gives them very full expression, but he does not harmonize them with his percentage formula.

[2] *Op. cit.*, pp. 71–73.

Another example of operator's estimate is the one which underlies every cost-accounting system at the point where it allocates the indirect costs. On what basis shall they be allocated: according to direct costs, direct labor cost, direct labor time, machine time, or some other basis? Here the question is usually one of finding something which controls the amount of these indirect costs, and the test would be that they would vary more nearly with this one variable than with any other. In this matter the expert's judgment is likely to represent a combination of direct tracing of such things as power expenses to machine hours, and of a sort of hypothetical experiment where output and costs are varied on paper and the effect of such variations estimated. Any selection that may be made is in the nature of a compromise, since some expenses vary more directly with labor time, others with direct expenses, others with machine hours, and so on.

But this is not the place for an extended study of the technique of cost accounting. The only purpose here is to give an idea of the difference between the different ways of analyzing cost, the strong and weak points of each, and why they should be used together.

5. CONCLUSION

The statistical method achieves its greatest possibilities where an association of producers, or some research body, can canvass a large group of productive units and study the typical behavior of their costs. Statistical analyses are so arduous that in order to make any very extensive sampling worth its cost, the results need to be made available to the trade or industry as a whole. On this basis, however, there is room for the making of many valuable studies. With these there should go a certain amount of analysis of internal statistics by concerns which can afford it.

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[1] Statistics of numbers only are misleading, because the average capacity has been steadily increasing. Such figures are much misused for purposes of propaganda.

The accounting method needs no defense, and will always have its place in industry, but cost accounting does need to develop greater freedom from the habits and standards of financial accounting. Perhaps it may develop into something which will not be accounting at all, but rather cost statistics and cost analysis. As for the method of operator's estimate, what it chiefly needs is to be more explicit as to its assumptions and methods, so that it may not put forth as universal truths propositions which are true only of certain limited situations and conditions. To repeat: all three elementary methods need to be combined in any adequate system of studying and interpreting costs.

CHAPTER XII

FUNCTIONS AND CHIEF METHODS OF COST ACCOUNTING

SUMMARY

Introduction, 233—Ten purposes of cost accounting, 234—How can these purposes be harmonized? 244—Direct expenses, 246—Principles governing allocation of indirect expenses, 249—The "cost of idleness" in cost accounting, 250—Allocating overhead among departments, 254—Is interest a cost? 255—Conclusion, 257.

1. INTRODUCTION

Cost accounting, as defined by Jordan and Harris, differs from general or financial accounting in that while general or financial accounting undertakes to show the total profit and loss of the business as a whole, the purpose of cost accounting is to give detailed information of the cost of a given product, job, department, or process, and to analyze this cost into its component parts.[1] It is a matter of recording the elements of cost in a classified fashion which shall serve to show what parts of the business are responsible for them and what different items of cost each part of the business is responsible for. This sounds as if cost accounting had its scope determined for it by financial accounting, its sole business being to analyze the figures which financial accounting sees fit to put down as "costs" for its own purposes (chiefly that of showing the total profit and loss of the business as a whole). This is only partly true, however. Cost accounting has sufficient independence to be in a position to include items of cost for its own purposes and then to exclude them again for purposes of making up the income account.

Strictly speaking, "books of account" are supposed to include only items which are destined to find their way into the income account and ultimately into the balance sheet, but it is technically possible to count interest as a cost for cost-accounting purposes, and then leave it out for purposes of financial accounting. We shall see more of this question presently. What, then, are the purposes of cost accounting?

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[1] See Jordan and Harris, *Cost Accounting*, pp. 3–4.

2. TEN PURPOSES OF COST ACCOUNTING

Since the writer is not an accountant, it requires some temerity, if not presumption, to discuss the technique of so expert a profession. However, he has no intention of discussing accounting from a technical standpoint, nor of entering into technical details. On the contrary, his purpose is to examine the underlying functions which cost accounting appears to perform, in the hope that the unconventional standpoint of an outsider may be able to throw a useful light upon the question of what cost accounting can and cannot be expected to do, and what methods are most likely to enable it to fulfil its general purposes.

If there is a central thesis in this discussion it is this: that cost accounting has a number of functions, calling for different, if not inconsistent, information. As a result, if cost accounting sets out, determined to discover what the cost of everything is and convinced in advance that there is one figure which can be found and which will furnish exactly the information which is desired for every possible purpose, it will necessary fail, because there is no such figure. If it finds a figure which is right for some purposes it must necessarily be wrong for others. The conclusion is that cost accounting needs to develop an elastic technique of a sort which probably could best be described, not as accounting at all, but as cost analysis or cost statistics. Accordingly, let us see what the chief purposes of cost accounting are.

These have been summed up under three main uses: to enable the concern to set a price that will cover cost and allow the desired profit, to eliminate waste in production and to guide decisions as to what product should be made. This list, however, is too brief and general to give a definite notion of the real task of cost accounting and of the kinds of information required of it. The guidance of price policy is not a simple thing, and requires more than one kind of data, since the relation of prices to costs of production is itself quite complex. Indeed, this relationship is so obscure and varied that some students of the question are inclined to deny that prices are based upon costs at all, claiming rather that the concern is governed by the market and merely charges what it can get. This is going too far, however. The concern always has some discretion, if only in deciding to cease carrying certain lines of goods which are not worth their cost, and to push others which are more profitable.

A jobbing carpenter and builder does a considerable part of his work on what amounts to a cost-plus basis: doing the work first and then charging for materials and direct labor, plus a percentage for overhead. A retailer commonly bases his prices on what the goods have cost him, plus a margin which is none too scientifically determined, and frequently governed by custom. In some kinds of manufacturing as well as in construction work, special jobs of large size are done on contract, and here the producer bids on the basis of what he expects his costs will be, rather than on the actual costs. If he guesses wrong, he may lose. Frequently, however, he runs no risk on the prices of his materials, being able to protect himself by securing options if he has not the materials in stock. He runs some risk of changes in wage-rates, and considerable risk as to the amount of labor-time which a given job will require.

As for manufacturers, they frequently send out price lists at the beginning of a season, and thus commit themselves on goods they have not yet made, in much the same way in which the contractor does, though they retain the power to revise the lists, and frequently make minor changes by varying the discounts allowed. A price list of this kind is, of course, based on expected costs rather than actual, while current changes which may be made from time to time are governed, among other things, by knowledge of the actual cost of goods already made and in stock. Sometimes, when the goods fail to move in a reasonable time, they may be disposed of without much reference to their actual cost, one of the chief questions being the cost of not selling them, consisting largely of deterioration, storage, and loss of interest.

From this brief and inadequate sketch of different types of price-making, it appears that while costs is an important fact, it figures at least as often in the form of estimates of future costs as of records of the costs actually incurred on account of the particular goods whose price is being fixed.

To sum up, the demands made upon cost accounting may be roughly catalogued under the following ten functions: (1) to help determine a normal or satisfactory price for goods sold; (2) to help fix a minimum limit on price-cutting; (3) to determine which goods are most profitable and which are unprofitable; (4) to control inventory; (5) to set a value on inventory; (6) to test the efficiency of different processes; (7) to test the efficiency of different departments; (8) to detect losses, wastes, and pilfering; (9) to separate the "cost of idleness" from the cost of producing goods; and (10) to "tie in" with the financial accounts.

Broadly speaking: (1) calls for a knowledge of what we may call the total economic sacrifice of production, including interest on all investment; (2) calls for a knowledge of differential costs; (3) and (4) call for total economic sacrifice, with possible deductions in special cases; (5) is controversial, some accountants including total economic sacrifice, while for certain purposes valuation is limited to operating expenses; (6) and (7) again call for total economic sacrifice; (8) calls for complete records of actual costs and also for standards of efficient performance with which to compare them; (9) calls for residual costs (total cost less sum of differential costs); and (10) calls for total operating expenses, but nothing more.

From this brief summary certain conclusions are apparent. Most of the purposes of cost accounting require statements covering the total economic sacrifices of production, but for some purposes interest on investment must be subtracted. Furthermore, certain purposes appear to call for a knowledge of differential and residual costs, and these cannot be found by merely subtracting certain items from a set of books which records all the economic sacrifices involved. Let us look at these functions a little more in detail.

1. In helping the management determine normal price, cost accounting may take different degrees of responsibility upon itself: (*a*) It may undertake to find the normal price or total sacrifice of production and report it to the management as the "cost" of the goods. Some of the more progressive cost accountants appear to have adopted this as their ideal of what cost accounts should do.[1]

b) It may merely report the necessary data out of which the management can form its own idea of normal price. These would include, at the very least, the direct expenses, divided into such parts as would correspond to the units of output on which the management might wish to set a separate price; the indirect expenses, similarly divided; and finally, if not included in indirect expenses, a record of this product's share in the total use of capital equipment. This last would not necessarily involve reporting interest as a cost; that whole matter might reasonably be left to the discretion of the management, and the accounts would still furnish valuable guidance toward making an estimate of normal price.

c) These figures, whether or not they include interest on investment, should be capable of being projected as an estimate into the future. To do this effectively the past experience of the concern should be so organized that it would not only show what normal costs would be under normal conditions but allow for changes in wages and prices and, to a certain extent, for changes in the rate of output. However, there is no need of reporting the increase in overhead costs per unit of product which results from a decrease in demand, for the effect of this on price policy would be pernicious, if it had any effect at all. For it is precisely when this element in cost is highest that prices are inevitably lowest. However, an increase in direct costs due to overtime is a fact worth reporting. To allow for changes in wages and prices, normal costs would need to be itemized in physical units—so much of a given material at so much per pound; so many hours' labor of a given grade at so much per hour. Then the figures could be corrected by merely substituting new money values.

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[1] Cf. C. H. Scovell, *Cost Accounting and Burden Application*, esp. chap. vii.

To make perfect allowance for different rates of output would require a series of these schedules of normal cost, showing cost at different percentages of the full capacity of the plant. However, much might be done in a far simpler way, by means of one schedule of direct costs under normal conditions of operation, another schedule of direct costs under an overload, and a "standard burden rate" for all the indirect expense. This last would eliminate the changes in burden per unit of output which result merely from the fact that the burden falls upon more units when the output is large, and fewer when the output small, since this change is irrelevant for purposes of price-fixing. However, the burden rate should be itemized sufficiently to show how much to allow for any changes in wages or materials entering into the indirect expenses.

2. "Normal price" implies that actual prices will be sometimes above it and sometimes below, and hence arises the further need for a minimum below which prices shall not go. The fixing of this minimum is perhaps a matter of business policy rather than of accounting, but one of the facts which is most pertinent is the differential cost of the goods. Goods sold for less than this are surely sold at a loss. Hence a knowledge of differential cost is one of the purposes which the cost accounts should help to serve. Here, as in the previous case, the information may be wanted for goods already produced or as an estimate for the future.

3. Another purpose of cost accounts is to help decide what goods to push and what goods, if any, to drop. Ordinarily, goods would not be actively pushed unless they were worth more than the total sacrifices of production, although an active selling campaign might sometimes be undertaken for the purpose of utilizing idle capacity, even though the price would not cover all the overhead costs. Here again there is need for an estimate of differential costs. When it comes to the question of dropping some product, there may be some specialized equipment which cannot be fully salvaged if the product is discontinued, or the

equipment may be of a general sort, capable of being used for other purposes. In the latter case, the figure for "normal price" would be the gauge of the desirability of continuing the product. Where there is some specialized equipment already committed, the irrecoverable part of this investment may be deducted as a "sunk cost," but otherwise the calculation is the same. It is a problem similar to the last one taken up in chapter ix: the problem of abandoning an unsuccessful plant.

4. The control of inventories involves information as to the amount and character of goods on hand, and presumably of the cost involved in carrying a given volume of goods, so that the concern may choose wisely whether to increase or to reduce its inventory. Even the simplest kind of information ought to make possible the elimination of a great many crude and obvious wastes, but really exact control of inventory requires a knowledge of the relative costs of different policies, some involving larger inventory and some smaller. In this comparison interest is one element, though not always a decisive one.

5. Another function is the valuation of inventory. The mere statement of this function does not convey an adequate idea of the dominant purposes which control it. It is at bottom bound up with the requirement that no dividends shall be paid which "impair the value of the capital." This impliedly permits the concern to pay dividends if the value of its assets is not thereby reduced below the amount set down in the books as a capital liability. Evidently the amount the concern can pay depends upon the method followed in valuing its assets, especially those which change their form rapidly. Any increased value which the books set on the assets may, technically, be regarded as "earned" and used as a basis for paying dividends.

This is virtually inevitable, but from it arises a most baffling confusion of terms, if not purposes. Costs must help to show the managers what the selling value of the goods *ought to be*. They are also used to set forth what the value of unsold goods *actually is*. If the same figure is used for both purposes, the result amounts to, *assuming that the value is what it "ought to be."* Moreover, this will produce the same excess of assets over liabilities as if the goods were already sold at the price they ought to bring. The books will show the same "undivided profits" whether the goods are sold or not. In short, the books will show the concern as *having already earned a normal return,* while the goods are still waiting to see if the market will take them at the necessary figure. Thus the company could go ahead and pay dividends based on whatever value their goods ought to sell for, without waiting to see whether this "ought" is anything more than the substance of things hoped for. In other words, when used as a basis for valuing inventory, "cost" becomes identical with "income" in its effect on the books. Hence accountants often appear to the layman to make no distinction between cost and earnings: anything charged as a cost is thereby "earned."

It is earned only in the sense of being an anticipation of the future selling value represented by goods unfinished or unsold, being treated as an estimate of the present worth of the prospect of selling these goods. This worth might be determined by expert appraisal at every dividend date, but it is far simpler to adopt a standard, based on cost, which will be on the safe side, so that an appraisal would seldom or never result in reducing the figure. For this purpose cost, including interest, would not furnish the desired margin of safety, so that it appears natural that cost without interest should be preferred.

Another consideration which tends to the same conclusion is the desirability of so arranging the accounts that thay will show income available for interest or dividends to just the extent that goods have been actually sold for more than they cost, no more and no less. Any finished transaction, if profitable, should furnish a basis for distribution of earnings, and unfinished transactions should not, ordinarily, affect dividend-paying power at all. They should neither increase nor diminish it. This proposition may not be universally agreed to, under all conditions, but it seems to represent customary business policy.

The system that appears to meet this requirement in the most natural way is one that allocates all operating expenses and stops there. Then if a concern made goods and did not sell them, its books would show no net earnings, but as soon as it sold any goods for more than their share of operating expenses, net earnings would appear. Even so the concern would make a better showing than if its unsold goods had not been made at all, since in that case it would be out all the constant expenses of operation and would have nothing to show for it. Making goods to stock increases the showing of income available for dividends by just the amount by which the book cost of the goods exceeds the differential cost. However, this is not an evil, and since the books cannot charge total cost and differential cost both, it seems more reasonable to charge total cost.

This is sufficiently conservative so that both managers and creditors may rest assured that there is no reasonable likelihood of impairing the capital. In settling this question the decisive influence is likely to be the standards of bookkeeping set by the banks as a condition of granting credit. They regularly insist that cost, as used to value the inventory, shall not include interest, or else that any interest so included shall be separately stated, so that the banks can make their own allowances.

6. The sixth purpose of cost accounting is to furnish means of testing the economic efficiency of different processes of production. There is some question whether this testing is a matter which cost accounting alone can be expected to carry out. Quite possibly it should be regarded as a task for engineering analysis, with the help of the data which the accounts furnish. Certain it is that this kind of comparison is meaningless unless it takes account of interest on the capital required for each kind of process, regardless of whether the ritual of accounting, as developed for other purposes, allows interest to be stated as a cost or not. If a process is wasteful of capital, that is just as serious as if it were wasteful of labor, and should have just as much effect on the costs, at least for this purpose.

7. Little need be said here of the seventh function of cost accounting: that of separating the costs and services of different departments in order to show which are most profitable and whether any of them are absolutely unprofitable. We shall return to this point presently. The question takes one form

where each of the several departments sells its own class of product, and a different form where the departments carry on successive stages of a productive process, and only the final department actually does any selling and produces any direct income. In either case, however, it involves an estimate of sacrifice on account of investment.

8. Another function is to detect losses, wastes, and pilfering. Here the important thing is to keep a complete record of all transactions so that materials and services cannot disappear without leaving gaps in the records. Aside from this, however, it is extremely useful to set standards of performance, with which the actual performance can be compared and by which it can be judged. Wherever standards of this sort are set up, there is likely to be an irresistible pressure to use them as incentives to increase efficiency; in other words, to set them a little higher than the records actually achieved. That is, standards of performance tend to be set higher and standards of cost tend to be correspondingly lower. These standards, however, are not part of the cost accounts themselves, except in one case, namely, the standard burden rate, which belongs under the next topic.

9. The ninth purpose of cost accounting is to measure the waste of idle time and separate it from the cost of producing goods, in order that cost of production shall not be unreasonably swollen by including what is essentially a cost of idleness. There are probably two salient evils which this proposition has in view and against which it is aimed. One is the fact that the cost of production in the shop or factory is at the mercy of the volume of sales and furnishes no reasonable test of the real efficiency of the factory organization, if efficiency means meritorious performance, unless the increases and decreases due to the changing volume of sales can be eliminated. Another evil is the absurdity arising from the fact that costs are highest when demand is lowest, merely on account of the fact that the indirect expenses do not shrink as fast as output and therefore fall as a heavier burden on each unit of output in dull times. But if costs mean anything as a guide to price policy, then it is absurd that they should go up at just the time when prices need to come down.

Moreover (and this fact is not always perceived) it does not cost any more to add ten units to your output when you are working at half capacity than it does when you are working at full capacity; in fact it very probably costs less. This means that ten added units at the same price will yield just as large a differential profit when the plant is working at half capacity as when it is working full—that is, just as large an increase in the net assets of the concern above what they would have been if the sales had not been made.

10. One further requirement might be mentioned, namely, that costs as reported in the cost accounts shall agree with costs as set down in the general books from which the income account and the balance sheet are made up. This is not absolutely necessary, but is extremely convenient, and furnishes a valuable check. And yet, as we have already seen, if cost accounting includes interest, it must be excluded again before making up the income account. So far as operating expenses go, the cost accounts can be made to check with the general books, but they need to be free on particular occasions and for particular purposes to do something more than this.

Wherever the cost accountant uses a standard or normal burden rate instead of the actual burden, this agreement between cost accounts and financial accounts becomes purely nominal. The sum of the actual financial costs of the business is one thing, the sum of the cost-accounting "costs" of the different products (including the "normal" burden, not the actual) is a different thing, and the books are balanced by setting down the discrepancy as a discrepancy, calling it "unabsorbed burden" or "over-absorbed burden" as the case may be. The wide differences of opinion as to how this discrepancy should be treated are evidence that the tying together of these two kinds of costs is a union of two essentially different things.

There is another requirement, or general presumption, under which cost accounting lies. This consists of a widespread and deeply rooted habit of thought among business men to the effect that prices must necessarily more than cover costs, and that a price below cost is an economic absurdity, or at least a very exceptional circumstance. This may be called a prejudice or a custom, though we have seen that it has a certain logical connection with another custom: that of valuing unsold goods "at cost." In either case cost must be less than "normal price." The costs which go on whether goods sell or not need not be covered in dull times; in fact, they generally cannot be covered in full.

There are times when it pays to sell some goods, at least, for anything they will bring over and above the differential cost of producing them rather than not producing them. Thus if cost accounting set out to be utterly and absolutely conservative, it would have to confine itself to the differential cost of the goods. But aside from the fact that this could not be made a matter of accounting record, it is carrying conservatism needlessly far. A "cost" based on the general policy of allocating all operating expenses is conservative enough to satisfy the business man's sense of fitness in this regard, and avoids adding one more to the array of conflicting notions of cost which have to be dealt with.

3. HOW CAN THESE PURPOSES BE HARMONIZED?

To sum up this survey of the different kinds of information required of cost accounting, it would seem to include some four things. First are the direct expenses of each job. Second is a fair share of indirect expenses, allocated to each job. These two sets of figures can be treated as an integral part of the "books" from which the income account and the balance sheet are made up. Third come estimates of total sacrifice of production, including interest on the entire investment, and all other overhead charges. These may be modified so as to take the form merely of allotting responsibility for a given amount of use of investment, leaving the management to translate this into a money charge on the goods. And fourth comes a varied assortment of comparative studies of cost, including cost at different rates of output, cost with or without certain processes or departments, etc., all leading to various sorts of differential cost. The first two requirements do not give much trouble, since such items as interest on investment may be included in the books and used when desired, or excluded from any statements for which they are not wanted. Or they may be excluded from the formal books of account altogether, and relegated to the field of special cost studies for special purposes. All this presupposes that the manager will have sufficient command over the cost figures, and sufficient understanding of them, to make them his servant and not his master.

The chief difficulty arises in the case of differential costs. As we have seen already, more than once, differential cost means a great many things and is something which the books alone cannot show. In the problem which was studied in chapter ix, the differential cost of additional output varied from $509 to nearly $1,300 according to circumstance, and if it had been a question of finding out the differential cost of one particular class of products as over against another class, this answer would have been different from any of the others.

However, in this particular case differential cost was found to move in fairly close harmony with the direct expenses of operation throughout the medium ranges of fluctuation, and in most businesses something like this is likely to be the case. And since no one expects a cost-accounting system to do more than furnish aids to the manager's judgment it is certainly not supposed to settle all problems in advance and render the manager's judgment superfluous the mere recording of direct expenses of operation will give the management a useful basis from which to judge what the differential costs are in any given case. His own experience should enable him to tell in a general way under what conditions to expect the differential cost to be more than the direct operating expenses or less. However, the manager's unorganized experience can be vastly helped toward exactness if he has the benefit of some organized statistical analysis of sample cases.

Let us now look for a few moments at each of the three chief constituents of costs: direct expenses, indirect expenses, and interest, from the standpoint of cost accounting.

4. DIRECT EXPENSES

It seems perfectly obvious at first sight that the direct expenses are economically traceable to just those products into which the materials and labor in question can be seen to disappear. For most purposes this is true, but there are some exceptions. When a concern is working full time and then takes on some extra work this may require paying labor a premium above the usual rate per hour or per piece, for the overtime. Then the cost of these last and most expensive hours of work is properly chargeable against the emergency orders which made the overtime necessary. If the men happen to be working on these extra orders during just these extra hours, then the direct expense would be a satisfactory record of the cost really due to this emergency work. But it is much more likely that they will work, say, the first five days of the week on their regular orders and all day Saturday on the emergency work, so that they will be devoting overtime hours from Monday to Friday to the ordinary work of the concern and the emergency work will be done, in large part at least, during regular hours and at regular rates of pay, so that it would not be charged with all the overtime which it made necessary.

Here the direct method of tracing costs is clearly no index to the economic responsibility which goods bear, nor of the cost caused by particular jobs or particular orders. The usual practice with regard to this is to distribute the overhead over all the work, so that it all shares alike regardless at what hour of the day a given job happens to be performed. This eliminates the most obvious element of pure chance from the calculations of cost, but it results in charging the emergency work with considerably less than the direct cost which it actually occasions. If this emergency work does not pay for all the overtime, including what is charged to other jobs as well as what is charged to it, it will not pay for itself.

Thus we see that there are questions of allocation, even in the case of direct costs. Even the regular procedure of cost accounting does not accept the fact that costs are directly devoted to a certain thing as a conclusive reason why they should be charged to that particular thing. In fact, in the case of overtime, it deliberately redistributes them. And this makes the direct costs a very poor index of differential cost of added business whenever overtime pay is involved. If the costs are to be kept in this way, the management should certainly be on its guard against taking emergency orders on the assumption that they cost no more than the books show. However, this is perhaps an academic issue, since a concern whose services are so much in demand is fairly sure to be making a good profit, at least on any new business which it takes. And in such cases, a nice attention to exact accuracy in the matter of differential cost is probably quite unnecessary.

Another interesting fact in connection with this problem is that if the concern could get rid of any part of its existing business, either the new orders which precipitated the overtime or the old orders which occupied its normal capacity, in either case the cost it would save would be the overtime cost. From this point of view the overtime is chargeable not merely to the new business but to the old business also. That is, if eight hours is the standard day and overtime is charged at 50 per cent above the standard rate, then when the concern is working nine hours a day one might say that any and all of its work is costing 50 per cent more than usual for direct labor. The one hour of overtime costs the concern, let us assume, 90 cents instead of 60, so that its expenses are increased by a total of 30 cents. But at the same time the cost attributable to the goods turned out has gone up, not 30 cents but nine times 30 cents, because if the concern could get rid of any hour's work, no matter whether it were the first hour or the last, they would save 90 cents.

From the standpoint of accounting this is an obvious absurdity, because the sum of the direct expenses of all the different jobs cannot be more than the total amount which the concern has to pay. But from the standpoint of tracing economic responsibility it is the plainest of common sense. Thus the requirements of the books of account and the requirements of a true economic analysis of causal responsibility for expenses may contradict each other.

In practice, the situation is often complicated by the fact that the regular business is produced under contract, so that the concern is not free to drop it when the emergency business comes up. Under such conditions there would be no particular logic in insisting that the regular business was responsible for all the overtime, and chargeable with the full amount the company could save by going back on their contracts and giving precedence to new orders. In such a case the really important calculation of cost, so far as the contract orders were concerned, was made when the contract was entered into. At that time the concern should have made an estimate of what its costs were likely to be during the life of the agreement. This would mean an average of the various possible conditions the concern might reasonably expect to prevail: so many weeks at part capacity, so many weeks at full capacity, and so many weeks under overtime pressure. Wherever this is the case it does not make any difference how the direct costs may be figured later on, except as it may have some effect in influencing the concern's judgment as to whether their contract has turned out advantageously or not. For this purpose the regular accounting method is slightly misleading but probably not sufficiently so to produce serious results.

Much the same question arises when the concern has on hand materials bought at different times and at different prices. Such differences are not relevant to the present cost of producing goods. One solution is to charge the materials at the market price prevailing at the time they are used. This is the most reasonable measure of the present sacrifice involved in putting these materials in the form of a product for sale. Then if the materials have gone up in price since they were bought, that will appear in the books as a speculative profit on holding the materials, not as a manufacturing profit on working them up. In the same way, when prices of materials have gone down, the loss will appear as a speculative loss on holding the materials, not as a manufacturing loss on producing the goods.

We have already noted the case of a concern which lost contracts through charging materials at actual cost, after the market had suffered a heavy fall, so that their competitors could get the advantage of much cheaper materials.[1] The concern had lost money on its materials, and their system of accounting led to recording that loss when they used the materials in a given piece of work, so that it appeared as a loss on that work (or as a lessening of the profit). But this put the responsibility in the wrong place. The loss was not due to working up the materials, but to having held them in stock while their value fell. This loss would not be lessened by insisting that the materials should be worked up only where it could be done at a price that would make good the shrinkage. That would merely lead to greater losses through reducing the volume of business, and postponing the time when they would buy new materials at the lower market prices and begin working them up at their usual rates of profit.

5. PRINCIPLES GOVERNING ALLOCATION OF INDIRECT EXPENSES

Indirect expenses are allocated to particular jobs on three principal bases. They are divided according to the number of direct labor hours, the direct labor costs, or by means of a "machine rate," a charge more or less in the nature of a rental for the use of a given machine or other unit of productive equipment. The machine rate may or may not include interest on the cost of the equipment, but it is, in any case, charged to the goods on the basis of the time during which they make use of this particular machine or "production center." This means that whenever a job is going through the shop or factory, the records which it carries with it must include not merely the materials used (so identified that their cost can be ascertained and charged against the job) and the amount of direct labor performed, so that the cost of this labor can be charged against the job, but also the time during which it was being worked on in any given production center, so that the proper rate of burden may be charged.

There is much dispute as to which is the best basis for allocating burden, or whether one basis should be used for some parts of the burden and another basis for other parts. Into the details of this discussion there is no need of entering here. The assumptions underlying the argument seem to be that burden varies approximately with one or the other of these indexes and that it is desirable to find the index which furnishes the best gauge of its variations, providing this can be done without too much trouble and cost in the work of accounting itself. This assumption that burden varies with some dimension or other of output needs some explaining in order to square it with the assumption underlying much of the discussion of "standard burden rates," namely, that burden is largely independent of output, so that the cost per unit grows heavier when the output decreases and lighter when output increases. The explanation is that burden is not absolutely unresponsive, but relatively so, and also that it is far more responsive to long-run movements than to short-run fluctuations.

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[1] See chapter ix, sec. 9, above.

6. THE "COST OF IDLENESS" IN COST ACCOUNTING

This subject cannot be better introduced than by some passages from an article by Mr. H. L. Gantt:[1] "In but few [manufacturing plants] are the machines and equipment in active use more than half the working time." The reasons for this can be mostly summed up under such causes as lack of orders, lack of material to fill orders received, lack of labor, and machinery out of order. The cost system which loads all the expense of the plant upon the product turned out is coming to be regarded by accountants as fundamentally wrong:

> putting on the product of one machine the expense of maintaining in idleness another machine which does not in any way influence the product. . . . . In our first attempt to find out whether we can afford to take an order or not, we must find out what expense we should be under for maintaining our equipment in idleness, if we did not take the order: for it is perfectly well understood by all thinkers on the subject that idle machinery is idle capital on which we lose not only the interest but the taxes and insurance on the machinery as well. If failing to take an order would cause idleness of machinery and equipment, we should incur an expense if we did

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[1] See the *Annals of the American Academy of Political and Social Science* (1919), p. 258.

> not take it; moreover, we should lose a part of our organization . . . . if we took the order at a loss equivalent to that caused by the above-mentioned idleness we should still be ahead, for we should not lose our organization . . . . we should be in a better position than our competitor who did not take a similar order.[1]

Here we have an unusually forcible expression of the essential problem of idleness and constant costs, implying clearly that business is worth taking at anything more than its differential cost. The natural conclusion would be that nothing but differential costs should be charged against the product, and all the residual costs should be left undistributed. As we have already seen, no accounting system can do just this; hence it will be extremely interesting to see what happens to an accounting system which tries to do it, and what sort of a working approximation is forthcoming.

Even if an accounting system could isolate those indirect expenses which remain constant as output varies, the result would not be the sort of thing suggested by the phrase: "cost of idleness." It would be, rather, the cost which is neither cost of production nor of idleness but of readiness to produce, regardless whether there is any production or not. If the purpose of the accountant is to isolate the cost of idleness as such, he will not naturally charge it with all the constant costs.

A hint to this same effect is contained in the suggestion that the causes of idleness are things for which management is responsible and over which it has control. This looks toward finding a quantity which would serve as an index of the efficiency with which management performs its task of eliminating idleness: something that would increase as idleness increased and vice versa, or in some other way serve as a barometer. Constant costs obviously would not do this: they represent capacity regardless of use or non-use. Evidently it is the *unexploited portion of the constant costs* which the accountant is bound to select in his quest for an index of managerial efficiency.

In setting up indexes of efficiency in general, a standard is set and actual performance compared with it. This is substantially what the "standard burden rate" does. It selects a "standard" output and estimates the total burden which that output should occasion, and finds the resulting burden per unit of the standard output. This gives a standard or normal burden, which can be allocated on any desired basis, with the result that product is charged with normal burden per unit, rather than with actual burden.

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[1] *Ibid.*, p. 259.

The nature of this standard or normal is a subject of much debate among accountants, some thinking of it as an average of a term of years, and others as representing the best possible performance.[1] In any case, the sum of the "costs" charged to the different items of product will differ from the actual costs of the concern for the same period, partly because the actual total burden will differ from the estimated normal total and partly because the number of units on which the standard burden is charged will be less or more than the estimated normal number. Other things being equal, if output is less than "standard," the sum of the "costs" of the different units of product will fall short of covering the total burden, and there will be a discrepancy designated as "unearned burden" or, better, as "unabsorbed burden," since the term "unearned" is confusing in this connection, having nothing to do with earnings actually received from sales. And if output is more than standard, then, other things being equal, the total burden charged against the goods will exceed the burden actually incurred, and the discrepancy will be of the general nature of a profit from full utilization.[2] This unabsorbed cost, or this "profit," furnishes the accountant's index of the "cost of idleness," though of course its meaning is wholly relative and depends entirely on the nature of the standard selected as normal. If performance exceeds the standard, the "cost of idleness" is a minus quantity.

But while it is fairly clear what "cost of idleness" means under this system, it is not by any means clear what the "cost of producing goods" means. It consists of direct costs actually expended, plus indirect costs at the normal rate. Goods are still charged with the costs which would go on just the same whether the goods were produced or not, and if business is turned away because it will not pay its "cost," then the ideal expressed by Mr. Gantt is not lived up to. However, what Mr. Gantt apparently presupposes is that the management will not insist rigidly that every sale must cover the cost of producing the goods, but merely that it must at least cover the excess of the cost of producing them over the cost of the idleness that would result from not producing them.

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[1] See discussion in *Year-Book of the National Association of Cost Accountants*, 1921.

[2] It is a "profit" in the sense that the book value of the inventory, at "cost," includes more than the costs actually incurred.

The cost of production includes direct expenses plus normal burden. The cost of non production includes the same normal burden, which would be added to the "unearned" or "unabsorbed" burden if the goods were not produced. Thus the two burdens cancel and the goods are worth producing if they cover their direct cost. This would be quite correct if direct costs varied exactly in proportion to output and indirect costs were wholly constant. For short-run purposes this is probably as good a rough approximation as is available. Thus goods do not have to be worth their "cost of production" to be worth producing, though it is more than doubtful if many managers interpret the figures for standard burden in this way.

What, then, does the "cost of producing goods" mean under this system? In terms of the practical results, it means two things. The costs charged to specific items of product absorb substantially all the operating expenses (at least over a term of years), while avoiding the absurdity resulting from the fact that costs per unit rise when business falls off and vice versa, owing to the behavior of the constant operating expenses. Both of these considerations have strong practical arguments in their favor and there is no need to reiterate them or enlarge upon them here. It is evident, however, that in order to fulfil its final practical function and prevent a concern from refusing business which would be worth its differential cost, the "standard burden" system of costs needs to be applied with some boldness by a manager who is not afraid, on occasion and for sufficient reason, to sell goods at less than "cost," as the books show it.

It is beyond the province of the present writer to criticize the principle of the standard burden rate as an accounting device. What has been said indicates its appropriateness to certain of the purposes which govern accounting. It undoubtedly serves certain useful functions. What the present study is competent to point out is that the "cost of production" resulting is not actual cost, average cost, normal cost nor differential nor marginal cost. It is actual direct cost plus "normal" indirect cost: a compromise which must be appraised according to its results.

Some advocates suggest that the use of "standard burden" will help materially to settle the unrest of labor by establishing the principle that capital is not entitled to earnings unless it is actually employed. This claim seems unduly pretentious. In the first place, the normal rate is usually set so as to allow for a certain amount of idleness on the part of the capital equipment. In the second place, even if there is a balance of unabsorbed burden, there is nothing to prevent profits on sales being high enough to cover it nothing in the accounting system, that is, for this is a matter entirely of what the market will afford. In the third place, the standard burden rate is not exactly a simple thing, in all its bearings and operations, and labor distrust will not easily be resolved by anything which complicates, rather than simplifies, the statement of profit and loss.

7. ALLOCATING OVERHEAD AMONG DEPARTMENTS

So far as manufacturing is concerned, the allocating of overhead among departments raises few serious problems. The equipment located in each department can be identified and separately valued, costs of power can be distributed according to amounts of power actually used, costs of the building can be distributed on the basis of space occupied, since there is generally no sufficient reason for reckoning one space more costly or more valuable than another, and the questions remaining are chiefly those of allotting a share in space or facilities used in common.

In large mercantile establishments, such as department stores, some complications arise, because the departments are mostly selling goods and each must show a profit, while a great deal may hinge on the space used by each department, both in the store and in the show windows. The usual method is to estimate the relative values of different spaces and apportion the costs of the building to the different departments according to the amount and kind of space used, so that if a department is to get the benefit of a week's use of the most prominent show window, or an increased amount of the most valuable inside space, it must have the value of this space added to its departmental costs, and must show earnings enough to cover it. A rival theory maintains that there is no absolute "best" or "worst" space, but that in a properly arranged store there is one appropriate and correct place for every line of goods, that the best place for jewelry is not the best place for sporting goods, etc., and that therefore there is no need for making any difference in charge as between ground floor and upper floors. This contention appears to be only partially borne out, however, and the method of allocation of costs according to estimated worth of space seems to be firmly established.

8. IS INTEREST A COST?

The foregoing discussion may serve to throw some light on the time-honored dispute whether interest is a cost of production. The discussion of this question is a strange mixture of dogmatic assertion and arguments from expediency, based on assumptions as to how a given policy would work. With some of the more moderate disputants, however, the issue appears to reduce itself to the question whether interest shall be charged in the formal books of account, or kept track of in a separate set of records and used whenever questions arise which require it. This degree of tolerance is a hopeful sign. From the standpoint of this study either system might serve all essential purposes.

Books which do not include interest are primarily adapted to the purposes of financial accounting, and cost accounting, or cost analysis, would in such a case be forced to the keeping of interest in supplementary records. Books which include interest are primarily adapted to the purposes of cost accounting, and the interest must be subtracted in making up the income account.

In either case there must be studies and analyses of cost which are not part of the books of account and need not be bound by any of their standards of procedure. In cases where the books exclude interest, and are thus adapted to financial rather than cost-accounting purposes, cost accounting might cease to have the distinctive character of accounting at all, and might become wholly merged in this broader and more elastic technique of "cost analysis." As between charging interest as a cost, and not charging it, the best system is probably the one which best promotes the development of this independent and untrammeled study of costs, and tends most to make accounting outgrow the attitude that cost is one thing for all purposes.

If the fundamental strategy of price policy comes to be governed by cost analysis rather than by accounting, then those who are interested in preventing cut-throat competition would not need to insist that the books of account should include interest as a cost, while those who are interested in the policy of free cutting of prices when necessary to utilize unused capacity would not need to oppose the inclusion of interest as a cost.

The argument on this issue runs the gamut of all the functions of accounting, each side emphasizing those which best support its case. The argument even reaches into the question of relations to labor and to the public, some holding that these relations would be improved by limiting the area of dispute to the return above interest the "net profit" in the language of the economist. Others fear that if this were done there would be a tendency to claim all of this "net profit" for labor or the public, whereas they hold that the concern needs some surplus earnings of this character in order to induce capital and enterprise to take the risks involved. This appears to be a matter of judgment on which the principles of overhead costs can throw little light. The issue seems a somewhat forced one. What labor or the public sees is the income account, not the individual cost charges to particular goods, and the income account does not naturally show interest as a cost. It seems doubtful if a technical matter of accounting can have far-reaching effects upon the deep currents of public sentiment and opinion.

9. CONCLUSION

Little more need be added by way of pointing the general moral of this very inadequate survey. It is apparent throughout that the purposes of cost analysis require a number of different conceptions and measures of cost, and the natural result is a plea for the development of a sufficiently varied technique to satisfy these quite independent requirements. The writer has little disposition to interpose in accounting controversies or to criticize the prevailing methods of accounting *from the point of view of the main purpose of financial accountancy*, which he takes to be the construction of an income account and a balance sheet. But he would insist strenuously that other conceptions of cost and profit must, somehow and somewhere, find adequate recognition and scientific treatment.

CHAPTER XIII

RAILROADS AND COSTS: A STATISTICAL STUDY

SUMMARY

Introduction, 258—Long-run trends, 260—Lorenz' comparison of different roads, 265—A case of daily fluctuations, 270—The seasonal cycle of traffic and costs, 273.

I. INTRODUCTION

Railroads have long been held up as a typical example of a business of large overhead costs, where "constant costs" absorb an abnormally large percentage of income. This is, in general, true, though some other industries, particularly public utilities, show an even larger percentage of investment to annual output. In this respect an automatic telephone exchange is probably entitled to first rank. As for manufacturing industries, they are not strictly comparable unless one uses the figures for "value added to materials" and ignores the cost of the materials that go into their products. The usual method of describing the behavior of railroad expenses is exemplified by Ripley's formula, which says that about half the operating expenses are constant and half variable[1] while taxes and return on investment are regarded as wholly constant. Since these last two items absorbed, at the time of which Ripley wrote, about one-third of every dollar earned, the upshot was that two-thirds of railroads' costs were counted as constant and one-third variable.

Combined with this, however, goes a clear recognition of the fact that the "constant costs" grow with the growth of traffic. Ripley shows that they have grown, over a term of years, substantially as fast as variable costs. Indeed, this is implied in his very assertion that constant costs remain persistently about two-thirds of the whole. They could not do this unless they increased substantially as fast as "variable costs." As we have seen, it is a mathematical impossibility for constant costs to remain constant and also remain two-thirds of the whole, if the rest of the costs vary.

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[1] Ripley in his *Railroads: Rates and Regulation*, chap. ii, develops this formula on a basis of "expert estimate" and also presents a considerable amount of statistical evidence as to the behavior of costs, none of which, however, supports this particular formula.

What this means is that *certain kinds of variations in traffic, limited in amount and duration,* do not affect the capital investment at all, while their effect on operating expenses is as if half of them varied in proportion to traffic and half remained constant. If the traffic offered for shipment increases beyond what the existing trackage and rolling-stock can handle, the result is congestion. Freight moves slowly, deliveries are delayed, and there comes a point beyond which the increase simply cannot be handled. In the meantime, "variable expenses" increase faster than the volume of service actually rendered to traffic.

On the other hand, the growth of traffic from year to year calls for more equipment, while many elements of operating expense which remained constant before now tend to increase. In short, the two kinds of variation produce totally different sorts of changes in costs.

In fact, there are quite a large number of different types of change which need to be distinguished in any discriminating analysis. There are very brief ups and downs daily, weekly, or monthly. Here there is little or no chance to increase the physical plant, so that business cannot increase beyond its extreme capacity on account of congestion and inability to move the increased tonnage. Thus the fluctuations are automatically limited to a range within the capacity of the existing facilities. A single road, to be sure, can borrow cars from other roads, provided they have them to spare, but the roads as a whole could not increase their rolling-stock by borrowing from each other. Operating expenses will vary with the volume of business, but daily changes may affect them quite differently from monthly or seasonal fluctuations.

As for the more permanent yearly growth; if slight, it may at certain stages involve an increase in rolling-stock only; soon, however, it will call for more yard-tracks, sidings, and station-capacity; further, it may make it economical to improve the quality of roadbed, on account of the saving in operating expenses which this makes possible. Ultimately, extra main-line tracks will become an absolute necessity. Even the capacity of one double-track line is elastic: it can be increased by improving the system of signaling at some extra expense. Meanwhile, operating expenses have been increasing, but in different ways. So long as the road merely puts more cars and engines on the line and runs more trains, train-crew expenses keep even pace with traffic. But when larger engines are bought and the roadbed improved so that they can haul heavier trains, then for a time, perhaps, this element of operating expense may not increase at all, though the cost of loading and switching and car repairs goes up. All these stages of growth exhibit, in a sense, different laws of cost, requiring separate study.

In this chapter we shall find it possible to distinguish, statistically, three grades of change: daily and monthly fluctuations and the long-run trend of growth. Some of the statistical material is in the form of comparisons of different roads for the same year, correlating cost with density of traffic. This obviously has nothing to do with the shorter fluctuations of business and cost, but it has a very considerable bearing on what any road must expect to pass through as its traffic grows and its plant and organization are adapted to meet the increasing demands made upon them. These figures are about the best indications available of the very long-run trends of growth.

2. LONG-RUN TRENDS

The movement of costs from year to year is warped by changes in the purchasing power of the dollar, until the increase due to increased traffic is impossible to distinguish with any exactness. This is especially true, of course, of the figures since 1913. In order to give these data much intelligible meaning, it would be necessary to construct a rough index-number of the cost of various goods and services entering into railroad construction and operation, together with figures showing what percentage of the plant was constructed at any given date (and hence at any given cost). Data are not easily available for an adequate study of this sort.

So far as money expenses go, operating expenses have increased more slowly than traffic throughout nearly the entire history of American railroads, producing a steady decline in operating expense for each unit of traffic. From the time the Interstate Commerce Commission began gathering its figures until 1896-97, this movement was helped out by a steady fall in the general level of prices. From the bottom point of prices until about 1910, increased economy in operating expenses was more than sufficient to overcome the upward trend of prices, so that with decreasing rates the roads showed increasing net earnings.

The period from 1911 to 1917 represents the turning-point. During this period, in spite of rising prices, operating expenses kept almost exact pace with traffic, while from 1918 on, the upward sweep of wages and prices has dwarfed all other movements so far as operating expenses are concerned.[1] Property investment, however, has grown more slowly than traffic, clear up to the present time (spring of 1923).[2] Evidently there has been a great reduction in the real cost of railroad transportation, but it is impossible to say definitely how much represents the effect of increased traffic and how much is due to improvement in the art of railroading.

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[1] These trends are so clear, for the most part, that a casual inspection of the Interstate Commerce Commission's figures suffices to establish them. For the period from 1911 on, the writer has constructed a table, comparing operating expenses with a composite traffic unit, consisting of revenue ton miles plus three times the actual number of revenue passenger miles. The results are as follows (fiscal years to 1916; calendar years 1916 and thereafter):

Year	Operating Expenses (Per cent of 1911)	Traffic (Per cent of 1911)
1912.......	103	103+
1913.......	114+	115+
1914.......	116−	112
1915.......	106+	106+
1916.......	116+	127+
1916.......	124−	134+
1917.......	149−	147+
1918.......	208+	152+
1919.......	231+	143+
1920.......	306+	153−
1921.......	239+	123+

[2] See Chart I, p. 263.

Certain of the physical statistics afford a little more light. Chart I (p. 263) shows the relative growth of trackage, cars, locomotives, property investment, and revenue ton-miles, for a period of twenty-one years. The number of cars and locomotives has far from kept pace with traffic, ever since 1909, but this fact does not justify the inferences so often drawn for propagandist purposes. It is neither an alarming symptom of under-equipment nor an evidence of superhuman efficiency in the use of a dwindling supply of facilities, for the simple reason that it has been almost entirely made up for by the increase in average capacity per car and per locomotive. Total freight-car capacity has nearly kept pace with traffic; fully so until 1916. And while 1921 shows a suspicious lag, it is not more than a few years of active building would suffice to restore. Judging by the experience of the years 1917, 1918, and 1920, there has been serious under-equipment, and any economies which may come from increased traffic will not take the shape of making it possible to get along with a smaller supply of car capacity in proportion to the amount of business.

As for locomotives, while their number has far from kept pace with traffic, their total tractive effort has, in general, fully held its own. Meanwhile the average trainload (revenue ton-miles per freight train-mile) has gone up from 396 tons in 1911, to 652 tons in 1920, subsiding to 578 tons during the depression of 1921. And the number of freight train-miles was actually less in 1920 than in 1911, by a fraction of 1 per cent, though freight traffic was 62 per cent heavier.[1] Evidently, during this period at least, whatever expenses are governed by the train-mileage might fairly be called constant so far as the effect of increased traffic was concerned. Increased traffic was being handled almost wholly by larger trains rather than by more of them. The increased trainloads were about equally due to increased carloads and to increased number of cars, carloads increasing materially faster than did the capacity of the cars.

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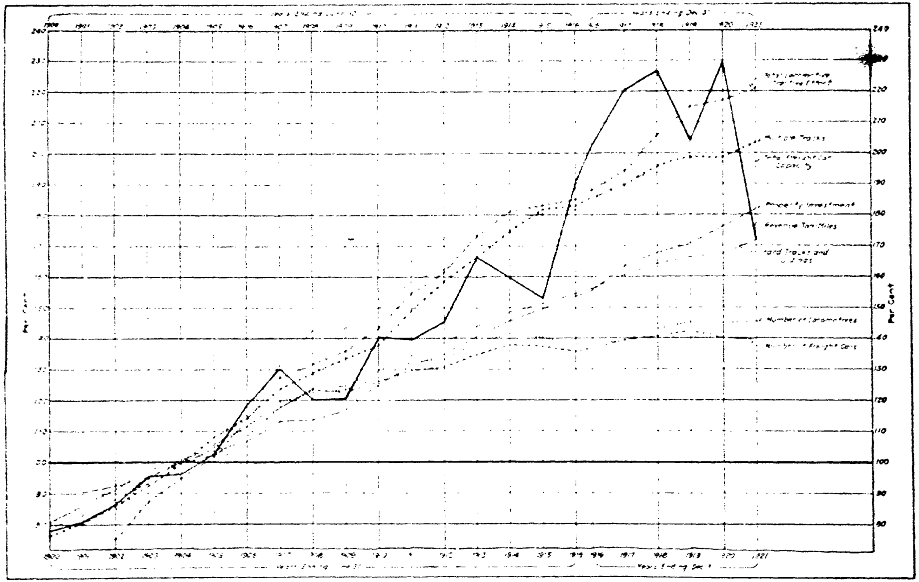
[1] See *Statistics of Railways of Class I, 1911–1921*, a statistical summary issued by the Bureau of Railway Economics, Washington, 1922.

CHART I



The percentage relationship of railway traffic and railway facilities on an annual average of 1902 to 1906, inclusive, as a base of 100. Reproduced by permission from the *Railway Age* (January 6, 1923), p. 20.

One probable effect of this increase in trainloads may be seen in the fact that the expense for maintenance of equipment grew faster than any other class of expenses during this period, increasing from 21.8 per cent of total operating expenses to 27.5 per cent. Since these major divisions of operating expense commonly maintain a fairly stable relation to each other, this large disproportionate growth in ten years is very significant. It looks as though the growth of trainloads has reached the point of increasing cost, not in the work of moving the train, but in the wear and tear on the rolling-stock.[1] This is aggravated because into these trains are coupled cars of different ages, many of which are not built for the strains on draft gear and underframe produced by the modern large trainloads. The safest place for such cars is at the end of the train, but this is not always easy to manage, and in any case the impacts of switching are bound to be hard on the weakest cars.

These longer trains require more yard tracks, but the track space occupied by the newer and larger cars does not increase nearly as fast as their total capacity, so that a considerable saving is possible here. Chart I shows that yard tracks and sidings have increased a trifle over 70 per cent while total freight-car capacity was increasing about 97 per cent. Multiple tracks have almost exactly kept pace with freight-car capacity—surely a coincidence, but suggesting the empirical generalization that the cost of a

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[1] This tendency to increased maintenance costs is shown in the following figures, taken from the statistical bulletin of the Bureau of Railway Economics, already referred to:

Year	Maintenance of Equipment. Percentage of Total Operating Expense	Revenue Ton-Miles per Freight Train Mile
1911	21.8	396
1912	22.3	421
1913	23.2	457
1914	23.6	465
1915	24.0	488
1916	25.1	550
1916	25.2	565
1917	24.1	603
1918	27.7	634
1919	27.0	637
1920	27.3	652
1921	27.5	578

single track may be regarded as a constant investment, additional line-trackage varying, in the long run, about in proportion to traffic, while other investment increases in a materially smaller ratio.

If one were to pick out a single central cause of economy that stands out in these figures, it is the fact that larger locomotives and cars take up less room on the tracks in proportion to their capacity, cost less to construct, and are generally more effective. In the case of cars, the larger sizes show a lower proportion of "dead weight" to paying load, though the largest cars are plainly in sight of the limit of desirable economy in this direction.[1] However, even where there is no more economy to be had from increased size of cars, there are savings which come from merely increasing their numbers, because larger repair installations are more economical.

Chart II represents an engineer's estimate of the investment necessary for adequate repair facilities. It shows a slight economy in the case of cars, and a very large one in the case of locomotives. This difference may be explained partly because there are so many cars that even a moderate-sized road can secure the chief economies of numbers, while locomotives are fewer in number. The character of the machinery used offers another possible explanation.

3. LORENZ' COMPARISON OF DIFFERENT ROADS

So much for the attempt to trace the yearly trend of railroad expenses. More definite quantitative indications can be arrived at in another way. Dr. M. O. Lorenz, chief statistician of the Interstate Commerce Commission, has published a very interesting analysis, in which he compares the operating expenses per gross ton-mile of about eighty of the chief railroads of the country and correlates them with density of traffic, after making allowance for one large disturbing factor—the varying length of haul.[2]

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[1] Figures given in the *Railway Age* (April 28, 1916), p. 936, indicate that a 70-ton hopper car is about as efficient as a 90-ton car, though either is more efficient than cars of 50 to 60 tons.

[2] *Quarterly Journal of Economics*, XXX (1915), 205.

CHART II

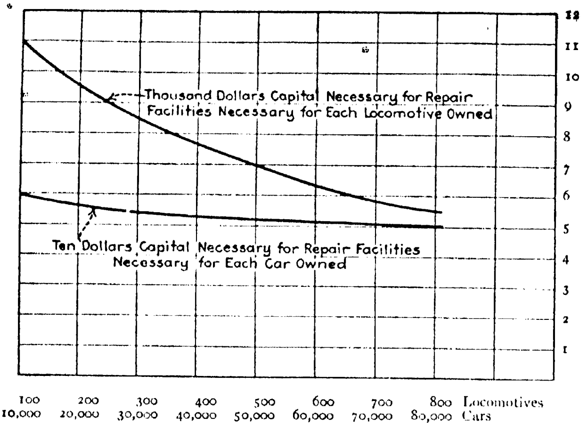

FIG. 1.—Showing desirable relation of repair facilities to equipment owned[1]

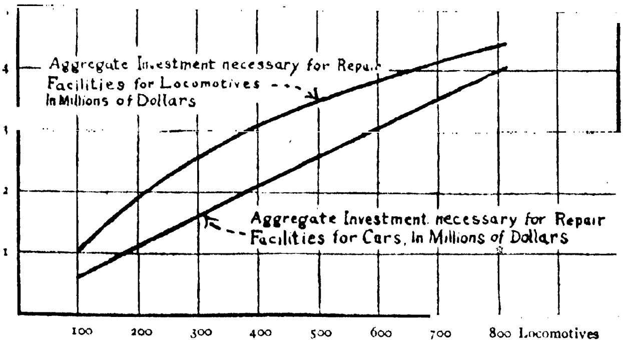

FIG. 2.—Showing desirable relation of repair facilities to equipment owned, translated into aggregates.

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[1] Reproduced by permission from an article by V. Z. Caracristi of New York, a consulting engineer, entitled, "What Shop Equipment Means to a Railroad," *Railway Age* (March 18, 1922), pp. 745, 747.

The result shows, on the whole, a very consistent trend, as shown in the accompanying diagrams (Chart III, Figs. 1 and 2). The figures given by Lorenz show operating expenses per gross ton-mile, modified so as to be correct for a 200-mile haul. These are

CHART III

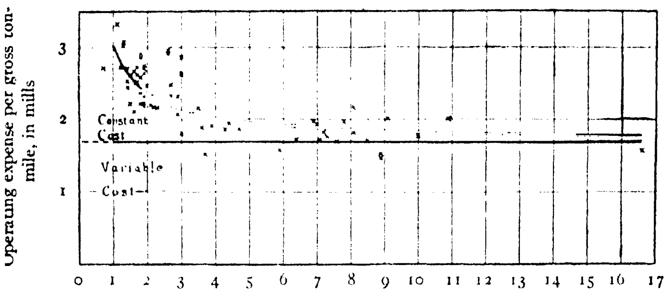

FIG. 1.—Gross ton-miles per mile of line (000,000, omitted)

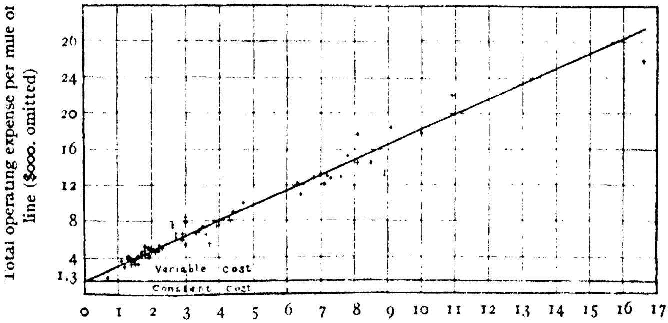

FIG. 2.—Gross ton-miles per mile of line (000,000 omitted)

shown in Figure 1, together with a curve constructed by the present writer on the basis of a constant expense of $1,300 per mile of line and a variable expense of 1.7 mills per gross ton-mile. This curve appears to fit the figures fairly closely, and in any case the downward trend with increased traffic is unmistakable, tapering off and almost disappearing as traffic becomes very heavy, precisely as would be the case with the general type of curve represented by a constant cost per mile of line plus a uniform variable outlay per ton-mile.

In Figure 2, the same data are presented, but converted into the equivalent total expense per mile of line, and the line which is drawn through them is the same line, translated into the new notation: $1,300 per mile of line plus 1.7 mills per gross ton-mile.[1] In Figure 2, one thing becomes apparent which was not visible in Figure 1: namely, that the trend of the points appears to be slightly concave downward. This may be due to other things than traffic, especially since the roads of least tonnage include most of those which run through mountainous country and have heavy grades and other accompanying difficulties to contend with. As the points stand, a broken line would fit them somewhat better than a straight one. Up to 2,000,000 ton-miles per mile of line, the trend is better represented by $800 per mile of line plus 2 mills per gross ton-mile, while beyond this point, $1,500 per mile of line plus 1.65 mills per gross ton-mile would show at least as good a fit. This broken line shows one interesting characteristic: namely, that for roads of light or moderate traffic, "constant costs" roughly approximate one-fifth of the total, while for most of the roads of heavy traffic (more than 6,000,000 ton-miles per mile of line) constant costs are more nearly one-tenth of the total.[2]

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[1] Incidentally, these two diagrams illustrate clearly the two ways of representing the economies of increased business, showing what happens when one is translated into the other. When total costs are used, constant expense is, of course, a horizontal line, and variable expense is a line sloping upward to the right. When costs per unit of business are used, constant costs take the shape of a hyperbola, the equation for which would be $xy = K$, that is, volume of traffic multiplied by cost per unit is a constant. Variable costs, if uniform in amount, now become a horizontal line.

[2] It would be possible to draw a curve such that *at every point* the differential cost of added business, multiplied by the total volume, would absorb four-fifths of the total expense at that point, leaving exactly one-fifth as "residual" cost. (It could not be called "constant," as it is continually changing.) The curve $y = 2.762\sqrt[5]{x^4}$ would satisfy these conditions, and would fit the points about as well as either the straight line or the broken line, up to 5,000,000 ton-miles per mile of line.

One disturbing element in these figures is due to the fact that they include railroads in different sections of the country, some predominantly in the prairies, some in the western mountain region and some in the east; some carrying chiefly coal and ore, and some moving large amounts of miscellaneous package freight. For that reason the writer has tried the experiment of dividing the roads into groups, so that each group should contain roads roughly comparable in the character of their traffic and the topography of the region through which they ran. One result was that the groups became too small to furnish good statistical material and in some cases covered too narrow a range of variation in density of traffic. Each group showed a trend very similar to that of the whole, but showing slightly less economy with heavier traffic. In other words part of the downward trend of costs per ton-mile is due to more favorable topography or larger percentages of cheap low-grade freight, or both.

For instance, the roads running through the Rocky Mountains show higher costs than any others for similar traffic densities, and their traffic densities are mostly below the 2,000,000 mark, so that one might say that the Rocky Mountains are under the left end of the curve, raising it higher than it would otherwise be. A correction for this factor would increase the variable cost of traffic in difficult sections, and reduce the constant costs in favorable regions, but the indications are that only a slight correction would be required. Variable costs of 1.7 to 1.8 mills per gross ton-mile and constant costs of $1,200 to $1,300 per mile of line would probably cover the range of the different sectional trends. Individual roads, of course, vary far more than this.

Here is a statistical hint of what a road may expect as traffic grows and its plant and organization grow with it. It tells a very different story from the formula which says that half the operating expenses are constant, yet it shows the whole outlay varying as if a part of it—one-fifth to one-tenth or less—were independent of traffic. If the same method of study were extended to cover interest on investment, and perhaps taxes, it would be found that they also vary with traffic, but not so directly as operating expenses. The constant element is larger than for operating expenses, and the variable element smaller. However, under present conditions of terminal congestion and high costs of real estate for terminal uses, it seems probable that the roads have reached a point at which investment increases fully as fast as traffic, wherever large cities have to be entered. It is not possible to secure accurate evidence on investment, as it is in the case of operating expenses. The best possible data on this point will be furnished by the valuation records secured by the Interstate Commerce Commission, when they shall be completely available. When that time comes, it is to be hoped that Dr. Lorenz will analyze them in the same way in which he has analyzed operating expenses, and so complete the picture.

4. A CASE OF DAILY FLUCTUATIONS

In the meantime, let us turn for a moment from long-run adjustments and examine some data of a very different sort, representing the shortest kind of fluctuations. These figures show the cost from day to day of handling freight in the Cleveland station of the Baltimore & Ohio Railroad, for the four months, January to April, inclusive, 1913.[1] Each point shows, by its horizontal dimensions, the volume of traffic on a given day, and by its elevation it shows the total expense of operating the terminal on that day and handling that volume of tonnage. (See Chart IV.)

From this chart several things are clear. Expense plainly varies with a great many other things than tonnage. Evidently less depends on the number of tons handled than on their character, and whether they come at convenient times or not, and whether the afternoon train is on time or late. If the force has to work overtime, expense goes up, and a washout on the line is quite as likely to be responsible for overtime as a heavy volume of tonnage to load and unload. In fact, costs appear to vary almost without regard to traffic, up to about 560 tons, and then comes a sudden change. Beyond that point costs not only increase, but increase a great deal more than tonnage. Thus the figures show the two chief characteristics of short-time fluctuations, in a rather extreme form—the comparative unresponsiveness of costs to traffic, and the congestion point or point of overload, beyond which costs are intensely responsive.

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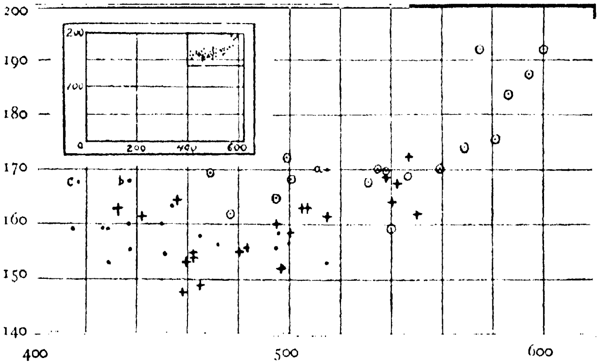
[1] The original article and chart from which these data are taken appeared in the *Railway Age*, February 25, 1916. The costs per ton were there given, but the present writer has taken the liberty of translating them into totals, because in this way the trend of the figures becomes much more evident to the eye.

In general production, this increase of costs is commonly due to green labor and heavy overtime charges, together with a substantial increase in accidents, spoilage of materials, etc. It may represent congestion of plant facilities, but it is quite as likely to register an overtaxing of the capacity of a labor force which cannot be easily and rapidly increased. Not every study of day-to-day fluctuations would show such a large percentage of costs independent of traffic. This depends largely on the system of wage payment. With a piece wage, direct costs, at least, would obviously vary almost in proportion to volume of work

CHART IV[1]



Cost of handling freight, Cleveland terminal, B.&O. Railway.
Horizontal scale, tons handled; vertical scale, total operating expense, in dollars.

• January, 1913
+ February, 1913
⊙ March, 1913
a, Accident on the line
b, c, Bad weather

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[1] Adapted from data published in the *Railway Age* (February 25, 1916). The small inset gives an idea of the range of fluctuations, by carrying the scale back to zero.

turned out, except for overtime, while almost every kind of work would permit the management to economize when business is slack to a greater extent than this railroad terminal seems to have been able to do. The expenses of hauling this same tonnage would behave differently from the expense of loading and unloading it. For any particular division on any particular day the critical point would be whether an increase of traffic made necessary the running of an extra train or not.

But we cannot spend the time necessary for a thorough study of these very short fluctuations. The chief reason for dealing with them at all is to show by a concrete example that the "variable cost" due to these daily ups and downs of production is quite a different thing from the variable cost appearing as the result of longer swings, so that it would usually require quite a different formula to express its behavior in any given case. The effect of daily fluctuations on expense appears to depend chiefly on the ease with which labor can be laid off or put on part time, and on the system of wage payment. These in turn are conditioned by the character of the work and the quality of labor required. Another important circumstance is the extent to which various kinds of postponable work can be utilized as eveners.

The chief economic importance of a study of such fluctuations consists in serving as a guide to reduction of the wastes that result therefrom. However, the financial outlays of the company, taken by themselves, would be a very imperfect index for this purpose, tending either to exaggerate or minimize the real wastes, according to circumstances. Where labor is freely laid off or put on part time, fluctuations may make little apparent difference in the unit expense of producing goods and yet there may be a considerable waste of productive power which the industry has, in the long run, to support. This means that they have to pay higher wages than they would if employment were more regular. On the other hand, if the company pays its men by the day and gives them a full day's pay even where there is not a full day's work for them to do, it is probable that on busy days the force does more work than could be gotten out of it for the same wages if the same pace were maintained day in and day out. Moderate changes of pace are rather favorable than otherwise to the efficiency of labor, so long as they are fairly evenly distributed so as to avoid cumulative fatigue on the one hand and times of undermaintenance and financial worry on the other. Within these limits, irregularity is not a waste, and the true cost of work, both to the laborer and in the long run to the employer, is about the same per unit in active and in relatively inactive times. For fluctuations within these limits, a day-wage system tends to exaggerate the waste resulting from daily ups and downs.

5. THE SEASONAL CYCLE OF TRAFFIC AND COSTS

So far we have studied the longest adjustments and the shortest fluctuations. There is an intermediate type of movement which it is possible to study in some detail, thanks to the fulness of the statistics published by the Interstate Commerce Commission: namely, the fluctuations from month to month. One obvious difficulty here arises from the disturbance due to changes in rates, wages, and prices of materials used. This, however, can be minimized, and, in fact, almost eliminated, by studying the typical yearly cycle and comparing, for a term of years, the average January with the average February, and so on. By means of this device it is possible to secure a very interesting picture of the seasonal cycle of traffic and costs on American railroads.

Railroading in the United States is a thoroughly seasonal industry. The cycle differs from road to road, and from section to section, while there is a different peak for mail and express, for passengers, and for different classes of freight. The passenger peak comes typically in August, while the dull time (November to March) appears to run about 77 per cent of the August peak.[1] The peak for mail and express is governed by the Christmas holidays, while the greatest aggregate fluctuations are in freight, and the peak here is governed by the moving of the crops and the autumn concentration of coal shipments. The economic preponderance of freight traffic makes this cycle outweigh all the others in its effect upon costs and earnings, the peak coming almost invariably in October for the country as a whole, with September a very close second, and the lowest point in January, with a surprisingly regular climb from January to September and October, and a rapid drop from October to January.[1] In general, the lowest month is about 80 per cent of the highest, the exact percentage varying slightly according to the measure employed. The difference between the lowest week and the highest week would, of course, be appreciably greater.

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[1] Based on figures for revenue passenger-miles, 1918–21, *Railway Age* (January 7, 1922), p. 18. The writer has made allowance for the differing lengths of the months.

As for the effect of this rhythm upon expenses, this constitutes a statistical problem of extreme difficulty; nevertheless the main results stand out clearly. Operating expenses vary with volume of traffic, and vary just about half as much as traffic does. In other words, the figures bear out the generally accepted formula, showing that "half the operating expenses are constant and half variable," *for these month-to-month fluctuations, but for no other type of movement.* Presumably the experts who gave us this formula had tacitly in mind fluctuations of about the amplitude and duration which these monthly figures measure. This formula is separately corroborated, in whole or in part, by three different statistical studies, using different measures of traffic and of expense. Thus, while the available units of measurement are very unsatisfactory, and disturbing forces are many, nevertheless this empirical rule of half-and-half may be regarded as reasonably well verified—for month-to-month changes only.

Before presenting samples of the results of such study in graphic form, some warning should be given as to the whys and wherefores of the diagrams. In the first place, they take gross earnings as a measure of traffic. Ordinarily, changes in rates would vitiate this measure, but they have little chance to vitiate a comparison of the average January, 1908–17, with the average February, 1908–17, and so on. Only seasonal changes could seriously disturb such a comparison. There are some seasonal changes of passenger rates, chiefly due to reductions in summer, but these are not sufficient to alter appreciably the general trends shown. There are also some changes from month to month in freight revenue per ton-mile, but these are due more to changes in the goods shipped than to changes in rates, and where such changes are concerned, ton-miles are no longer an accurate measure of essential service rendered. For instance, ore is carried almost entirely during the six months from May to October, inclusive, or, say, between the middle of April and the early part of November. This is due partly to dependence on the Great Lakes, and partly to the fact that iron ore, for example, freezes in winter and cannot be dumped. But ore is low-grade freight, moving in huge trainloads and handled very cheaply, and the same amount of work will move far more tons of ore than of mixed merchandise. As a result, it seems probable that earnings are a better measure of service rendered, on the whole, than ton-miles, for the purpose in hand, since the low rates on commodities handled in bulk are a rough measure of the low cost of rendering this service. Otherwise, months when bulk traffic is unusually heavy would show a false economy, due, not to the volume of traffic, but to its character.

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[1] In this statement allowance is made for the different lengths of the months: otherwise February would appear to be the month of lowest traffic. This point will be more fully discussed below.

Furthermore, the figures show a climatic cycle as well as a traffic cycle. Transportation costs rise with winter blizzards and spring floods. Coal consumption per gross ton-mile may be as much as 50 per cent heavier in winter than in summer,[1] and train crews spend more time on their runs. Maintenance of way and structures on the other hand is lightest in winter, when many roads renew no ties at all. Some roads, in fact, divide their maintenance-of-way budget into twelve equal parts, and charge each month with its quota, regardless of the time when renewals are actually made. Thus the figures for maintenance of way and structures are worse than useless as indexes of the effect of traffic on costs and must either be allocated on some reasonable basis or disregarded entirely.

With these things in mind, we may look at Chart V,which gives some selected results representative of a considerable num-

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[1] Based on figures reported for one division of the Baltimore & Ohio Railroad. 1918–20.

CHART V

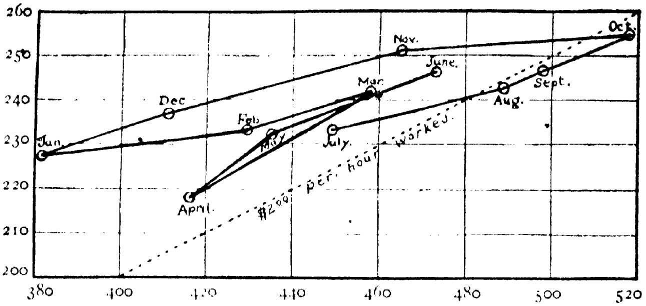

FIG. 1.—Gross income (horizontal scale, $000,000 omitted) and hours worked, omitting maintenance of way and structures (vertical scale, 000,000 omitted) for large steam roads, U.S., July, 1921 – June, 1922 (figures reduced to equivalents for 30-day periods).

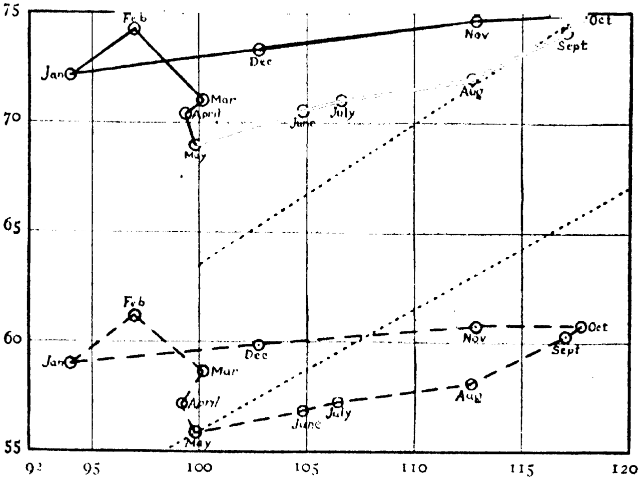

FIG. 2.—Gross income (horizontal scale) and operating expenses (vertical scale) for large steam roads, U.S., average yearly cycle, July, 1907—June, 1917 (figures reduced to equivalents for 30-day periods and yearly upward trend eliminated, $000,000, omitted).

Solid line, operating expenses, with maintenance of way and structures allocated as two-third constant and one-third variable.

Broken line, operating expenses, omitting maintenance of way and structures.

Dotted lines show trends as they would be if expenses varied proportionately with earnings.

ber of similar attempts to bring some sort of order out of this confusion. Figure 1 covers a single space of twelve months, and measures cost in terms of hours worked, while Figure 2 covers a term of years and measures expenses in terms of money.[1] Either method eliminates the effect of changing wage-rates. Both show clearly the effect of weather as well as the effect of traffic, the result being a loop. In Figure 2, the increase from May to October is on a lower scale of costs than the decrease from October to January, while February shows the effect of winter at its height, and the downward trend from February to May clearly has little to do with traffic. The best index of the effect of traffic is probably the trend from May to October, for here costs are not materially disturbed by weather conditions. During these months costs grow almost exactly half as fast as traffic.

In Figure 1, the winter increase in coal consumption is not included, which may account for the fact that the gap between winter and summer is smaller than in Figure 2. The yearly drift upward appears also: May and June, 1922, start off on a higher level than the trend of July to September, 1921. In fact, if one of these studies were prolonged through several cycles, by overlapping averages, the result would be a form of spiral, in which could be seen both the monthly variation, and also the yearly rise, as shown by the trend of successive Januaries, successive Februaries, etc. This yearly trend shows costs rising faster than traffic while, in the same curve, the May-to-October trend shows costs rising half as fast as traffic, thus exhibiting plainly that these two movements are independent of each other and follow different laws.

The only other study of this character which has come to the writer's notice was made, apparently, on one road only, and led to the conclusion: "For this particular railroad it is to be expected that the per cent of increase or decrease in man hours and expense will be about one-half the per cent of increase or decrease in traffic. The actual results on one railroad were 56 per cent for one year, 58 per cent in the second and 57 in the third."[1] Further than this, the actual results of the study cited are not published; only figures which are "fictitious but indicative of the results obtained." The measure of traffic used was a compound one made up of gross ton-miles for freight, and passenger train-miles for passengers, but the article did not state what weights were given the two figures. In any case, passenger train-miles would not naturally be expected to vary as much as passenger-miles, a fact which would tend to make the resulting percentages larger than if passenger-miles had been used. (This study was made for the purpose of setting standards of operating efficiency rather than for any purpose connected with traffic policy.)

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[1] The source of these data is the bulletins of monthly revenues and expenses, and of employees and compensation, issued by the Interstate Commerce Commission. In constructing Figure 1, the writer made use of a tabulation prepared by Mr. S. H. Nerlove, of the School of Commerce and Administration, University of Chicago.

To say that half the expenses are independent of monthly changes in traffic may be roughly true, but it tells only a small part of the story of the seasonal cycle of traffic and costs. The main divisions of expense—maintenance of way and structures, maintenance of equipment, transportation and traffic—all have their special peculiarities. Maintenance of way and structures, as already noted, seems to be distributed wholly according to weather, yet the wear and tear of traffic causes damage which must be made good sooner or later, and this damage is a cost, even if the books do not show it. In the upper curve of Figure 2 (Chart V), this unrecorded variable cost is estimated at one-third of the total outlays of this class.

Maintenance of equipment is also in part a postponable expense, so that the expenditures in any month do not record accurately the wear and tear taking place during that month. Equipment may need repairs and still be able to move, and such equipment will be kept on the line when the traffic is heaviest. The natural tendency is to distribute repairs over the months preceding and following the peaks, so that the heaviest outlays might come during the months before and after the heaviest traffic. The writer has seen figures for one road indicating just this kind of behavior. Both classes of maintenance expense include depreciation charges, which go on at a uniform rate, even though actual depreciation may be heavier in some months than in others. On the whole, then, it appears that the true variable cost is appreciably larger than the figures show. Also, this differential cost is apparently about 10 per cent larger in midwinter than in the months from May to October. And it is quite possible that any attempt to fill up the midwinter depression in traffic would increase differential costs still farther.

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[1] *Railway Age* (July 1, 1922), p. 12.

One of the most important features of this cycle is the utilization of the labor force, and here one of the chief questions is whether the changes are taken care of by changing the number of hours worked or by laying men off and taking them on. With regard to this, the figures show that, except for maintenance of way and structures, the number of workers employed remains remarkably steady. Fluctuations are taken up chiefly by working more or less hours, and these changes are not large enough to be serious, except as they may be concentrated on special groups of laborers.[1] In maintenance of equipment there is, however, a change of perhaps 14 per cent in the number of employees, while in maintenance of way and structures only about two-thirds as many are employed in midwinter as in summer. Evidently the chief burden of casual labor falls upon this last group of workers, and it is not to be remedied by stabilizing traffic, since traffic has virtually nothing to do with the distribution of their work.

The effect of this seasonal cycle on net earnings is most striking. The autumn peak typically shows twice the net earnings of the winter depression.[2] The autumn months thus appear by far the most profitable, though really the reverse is more nearly true, since this autumn traffic is responsible for the size of the investment and for a large part of the maintenance charges on this investment, charges which fall on the other months as part of their burden of "constant costs." Additional business "on the peak" would cost the roads vastly more than additional business in the off months, even in winter when costs per unit are increased by bad weather conditions. To whatever extent it may be practicable to reduce the seasonal swings of traffic, the result will be a saving in interest and maintenance, and an increase in efficiency that would be worth very considerable effort and sacrifice.

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[1] These statements are based on Mr. Nerlove's tabulation (already referred to, p. 277 above, footnote) of the Interstate Commerce Commission's monthly bulletins of employees and compensation.

[2] Based on figures published by the Interstate Commerce Commission for 1912–16, inclusive. In subsequent bad years, net earnings have reached the vanishing-point during the off season.

Can these gains be secured? The question is not a simple one, partly because the same shift of traffic that would mean a better load-factor for one road might mean a worse one for some of its connections. The simplest economic weapon is a system of seasonal rates, offering concessions to off-peak business and putting relatively heavier burdens on business which aggravates the peak. Taken by itself, this would ordinarily not have much effect except to reduce the roads' revenues, because it would be easier to get authorization to reduce the off-peak rates than to increase rates on the peak, while the rail rate alone would not, in most cases, offer sufficient inducement to ship goods at a less convenient season. The thing requires patient planning and the co-operation of miners, manufacturers and merchants: in short, of all the interests concerned in the efficient handling of the business in question. The railroads' reduction of rates would then be only one of a series of concessions by different interests and in various forms, all made in recognition of the economy of utilizing idle overhead.

Not every irregularity would be possible or desirable to eliminate. The crops will probably always move seasonally, though storage near the farm may in some cases make shipments more regular. Traffic in coal can undoubtedly be made more regular if miners, railroads, dealers, and large users act together. Ore offers no prospects of furnishing anything but seasonal traffic; and so on. Each commodity presents its peculiar problems, but here and there will be found opportunities for improvement. The chief thing needed is a vivid realization that additional off-peak business is profitable at anything above its differential cost—say 40 per cent of average rates—and that added business "on the peak" is a loss unless it yields considerably more than the present average rate.

CHAPTER XIV

OVERHEAD COSTS AND RAILROAD RATE PROBLEMS

SUMMARY

The lowest remunerative rate, 281—Traffic in busy and in dull seasons, 282—The segregation of railroad expenses, 287—Terminal costs, 288—Haulage costs and distance, 289—Adaptability of a "cost" system of rates, 290—Some principles bearing on discrimination, 293—Making money by lowering rates, 295—Conclusion, 297.

I. THE LOWEST REMUNERATIVE RATE

Railroad rate-making in this country has grown up on the practice of "charging what the traffic will bear." The theory of overhead costs has been used chiefly to justify this practice and to give it the benefit of the doubt, and only secondarily to attempt to set quantitative limits on it. Where such limits have been thought of, the minimum has been conceived as "variable cost," using the formula which states that half the operating expenses are variable and nothing else; or else an attempt has been made to trace the direct operating expenses attributable to the traffic in question, and set this as a minimum. This question of the minimum below which discrimination should not go has gained increased practical and legal importance since the Interstate Commerce Commission laid down the rule that relief from the long-and-short-haul clause should be granted only on condition (among other things) that the lower rates were in themselves remunerative. Under this rule, how much discrimination is justified?

To set the minimum at half the operating expenses is clearly wrong, in the light of the foregoing study, since this is applicable only to seasonal rates made to stimulate off-peak business—a type of discrimination which is virtually nonexistent and has nothing to do with the long-and-short-haul clause. To disregard investment costs and indirect operating expenses is equally wrong, in the typical case, for the typical case involves a general rate policy, which, if it is consistently followed, will call forth considerable volumes of traffic, which will in turn involve an increase both in indirect operating expenses and in investment. What should be reckoned is the long-run differential cost of growth of traffic, taking for granted that it will grow for an indefinite time and in very considerable amounts, and that the railroad which has brought this traffic into being cannot afterward refuse to handle it, nor hamstring it by raising rates to an extent which would cripple the shippers.

Judging by the evidence analyzed in the previous chapter (especially Chart III) the amount of discrimination which would be possible without making the lowest rates absolutely unremunerative would depend upon the density of traffic on the road in question. The minimum remunerative rate would not vary markedly between roads of dense and roads of sparse traffic, since differential cost does not appear either to rise or fall materially as traffic increases; but average cost varies greatly, and hence the relation of the minimum to the average would vary. Allowing roughly for the variable element in interest and taxes, it would be fair to conclude that the lowest remunerative rate would be not much less than three-quarters of the average rate for the country as a whole. For roads of very dense traffic, whose rates are below the average, this would leave very little room for discrimination on the principle of "charging what the traffic will bear." For roads of sparser traffic and higher average costs, it would be reasonable to charge a higher average rate, if they could get it, so that in their case the range between the minimum rate and the average would be considerably greater. For roads of sparse traffic, then, the lowest remunerative rate might be as low as half the average cost, including interest and taxes. This would, of course, leave a very wide margin between the highest and the lowest rates, in case such roads attempted to "charge what the traffic would bear" in the literal sense of exacting the utmost from traffic which would stand high rates.

2. TRAFFIC IN BUSY AND IN DULL SEASONS

So far we have been going on the assumption that the traffic is average traffic. If its special characteristics make it more expensive than the average, or less expensive, this difference should, of course, be taken account of. The characteristics of traffic, which affect its cost, are almost too numerous to attempt to mention. One, however, is worth mentioning because it is so generally overlooked in discussions of the subject: namely, the seasonal character of the traffic. Does it come chiefly in the busy season, is it evenly distributed or best of all does it concentrate in the partly idle season when it can be carried by the regular force and the regular equipment which the "peak" traffic makes necessary in any case?[1]

There is every probability that traffic which falls heavily on the September-October peak does not pay its fair share of the "capacity costs," including interest and taxes as well as those operating expenses which do not vary with seasonal ups and downs of traffic. The crucial point is the locating of responsibility for these capacity expenses, and in this there is large latitude for judgment, but an example may serve to make plainer the nature of the case on which judgment has to be exercised. This example will deal with freight haulage costs alone, taking for granted for the moment that expenses have been separated as between passengers and freight, and as between terminal and haulage outlays for both classes of traffic.

Let us suppose a freight traffic of 2,000,000,000 gross ton-miles per year with total haulage costs of $6,000,000 or 3 mills per gross ton-mile, including $4,400,000 for operating expenses and $1,600,000 for interest and taxes on the investment assigned to freight haulage. Operating expenses then come to 2.2 mills per gross ton-mile, and interest and taxes to .8 mills. Of these expenses only half of 2.2 mills, or 1.1 mills, are variable with seasonal changes of traffic, but in the long run the differential cost of added business will come to about 2.25 mills (three-quarters of 3 mills), assuming that this is a road of fairly dense traffic. This 2.25 mills includes the equivalent of the 1.1 mills of short-run variable costs and a residuum of 1.15 mills per gross ton-mile which, for lack of a better name, may be called "capacity costs." They vary in the long run, but not from month to month, and are governed more by the capacity of the road than by its momentary output.

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[1] Theoretically, there are two peaks to consider, the peak for the road as a whole and the peak for the special kind of rolling-stock which this traffic requires. In the case of freight, however, the curves of demand for box cars, open top cars, flat cars, stock cars and even refrigerator cars, are enough alike so that one might fairly ignore their differences for most purposes. (See diagrams of car shortages and surpluses covering 1919–21, *Railway Age*, January 7, 1922, p. 17.) Passenger train equipment, however, is a different story, and has its own distinct peak.

These capacity costs should be fully borne by the traffic which makes them necessary and all traffic should bear its share, but what is the share of a given class of traffic? If the seasonal peak on this road is of the usual magnitude, it will amount to about 185,000,000 gross ton-miles for the heaviest month, but since September and October are so nearly equal, it is fair to think of the peak as lasting two months. Now, strictly speaking, these two months are chargeable with the entire "capacity cost" for the year. A 5 per cent increase in the peak traffic necessitates a 5 per cent increase in capacity, and nearly that much in capacity costs, while an increase or decrease in the off-peak traffic will have no effect on them whatever. The total capacity costs come to $2,300,000, and distributed over a two-months peak they would come to 6.22 mills per gross ton-mile of traffic during the two heaviest months. Thus the lowest remunerative charge (to cover haulage costs only) for September or October traffic would be 6.22 mills plus 1.1 mills or 7.32 mills per gross ton-mile—more than twice the average cost for the whole year. Terminal costs would presumably behave in similar fashion, with the result that the road not only could not afford to cut rates to increase its peak traffic, but would lose money on that traffic unless it yields considerably more than twice the average rate! If this basis of calculation is correct, most roads are losing money on their heaviest month's business.

This is on the assumption that the "capacity costs" are governed entirely by the demand of these heaviest months, and not at all by the traffic offered the rest of the year. This, however, is probably not strictly true. If the off-season traffic were very small, the roads would not provide as good quality of roadbed and equipment for the peak traffic as they now do.

These capacity costs represent, not merely a surplus of cars which lie absolutely idle in the dull season, but improved roadbed and better facilities, which mean lower operating costs throughout the year. Even the surplus of cars is in part a relative matter: it makes it easier to furnish a shipper promptly with just the type and size of car he calls for and so is not wholly useless. Thus the peak does not stand absolutely alone as sole cause of the capacity costs, and it is not really correct to charge the entire capacity cost to the two peak months. When we ask how much of it to charge to the peak and how much to distribute over the other months, the question ceases to be a mere matter of arithmetic and becomes a matter of judgment.

Let us say that half the capacity costs, or at the very least a third, are fairly chargeable against September and October and the rest against the other months of the year. On the half-and-half basis, the cost of the September-October traffic would be 4.11 mills per gross ton-mile, while the off-season traffic would cost 1.734 mills. If only one-third of the capacity costs were charged to the peak months, the peak traffic would cost 3.22 mills and the off-peak traffic 1.95 mills. Thus, on the most favorable possible assumption, the long-run differential cost of traffic coming during the peak months is more than the average unit cost of all traffic, including a pro rata share of interest and taxes. This corroborates the inference that, at average rates, the roads actually lose money on their months of heaviest traffic instead of making their largest profits out of those months, as they appear to do on the face of the accounts.

Should this fact find expression in the rates? Common sense says that it should be taken account of in some way or other. Should rates in general be made higher in September and October than in the other months so that the traffic during these months should earn its fair share of the costs of unused capacity which go on during the rest of the year? The answer to this question is not simple nor clear. Certainly such a step should be taken only after thorough study of the burdens it would impose on industry and the extent to which it would be possible for industry to escape these burdens by shipping at other times, without increasing its own costs more than it would reduce those of the railroads. For this is not merely a railroad problem: it is a part of the larger problem of the seasonal character of industry in general, and it will not be solved until industry as a whole takes effective steps to estimate the costs of seasonal irregularities and to reduce them wherever possible. Seasonal rates on railroads may be justified wherever they show promise of producing actual results as a part of some such comprehensive policy. Taken by themselves and imposed indiscriminately, they would probably do more harm than good.

A compromise measure would be to make no seasonal changes in rates, but to distinguish between those commodities which tend to aggravate the seasonal cycle and those which tend to improve it, charging the latter higher rates the year round, so that each class of traffic will pay for any idle overhead it may occasion. This appears legitimate enough, but it does not do anything definite to make any given shipper ship at more convenient times. Thus it neglects the chief point which must underlie a scientific rate system.

While the seasonal peak in passenger traffic is quite as well marked as in freight, the economic questions which it raises are even more involved. The peak comes in the months of vacation travel, when freight traffic has not reached its peak; therefore, so far as passengers and freight use facilities in common, the heavy passenger traffic is off-peak business. There are also shorter peaks at other seasons—notably the Christmas holidays—to complicate the situation. And there is a large "overload capacity" in passenger facilities, since travelers will endure overcrowding at rush times which would rouse an insistent demand for more accommodations if it became chronic. Hence it is hard to locate the responsibility for the capacity expenses. Clearly the peaks of travel are not the sole governing factor, and probably not the main one. Thus it is virtually impossible to set up any particular system of passenger rates as embodying the one scientifically correct seasonal distribution of overhead expenses.

3. THE SEGREGATION OF RAILROAD EXPENSES

What about the separation of expenses between passengers and freight and between terminal and haulage? This is a controversial point, and the merits of the argument depend largely upon what use is to be made of the allocation. If the entire expense is divided into two parts, passenger and freight, and if it is then insisted that passenger and freight traffic must each earn the entire expense charged to it, no more and no less, then it becomes pertinent to object that many facilities and services are used in common and that bases for allocating these common items are necessarily arbitrary and full of shortcomings, so that any division based on them has little claim to scientific exactness.

These objections, however, would lose most of their force if the division of expenses were to be used in a more moderate way, insisting merely that each main division of traffic should at least earn the sum of the long-run differential costs for which it is responsible. This would be little less than the whole cost for roads of dense traffic, leaving them little room for "charging what the traffic will bear." But the sum of the differential costs would be far short of the whole, giving wide latitude for discrimination, in the case of the poorer roads with sparser traffic, which naturally have the hardest time to cover their overhead costs and need the most freedom of rate policy. If the separation of expenses were to be used in this way, the management might decide that passenger traffic could not afford to bear any of the residual costs and these might be thrown on the freight traffic; similarly it might be decided that the terminal portion of the rate should not be burdened with these costs, and they might fall entirely on the haulage portion. Such a policy might seem extreme, but would be within the range of discretion which the proposed rule would allow the management.

Under these conditions, the separation of costs appears less doctrinaire and inexorable. In its support four propositions may be laid down. (1) All expenses vary, in the long run, with utilization. (2) The variable component can be roughly calculated. (3) Indexes of utilization are imperfect, but an imperfect index is better than none. (4) The use of such indexes to allocate costs, and the requirement that each class of traffic shall cover at least the long-run variable component of the costs allocated to it, would tend to prevent parts of the traffic from being a burden on the rest, but would not unduly limit the discretion of the management.

4. TERMINAL COSTS

The separation of terminal and haulage costs might be used to make a rough allowance for length of haul, charging each shipment for two terminal handlings, regardless of distance, plus a haulage charge of so much per ton per mile. Such a system, however, would unduly simplify both the terminal and the haulage costs and services. Cost of haulage is different for solid through trains and for mixed local trains, and some services of a terminal character have to be repeated at transfer points, where carloads of mixed shipments for different destinations are unloaded and reloaded into straight carloads for single destinations, or where trains of cars for different destinations are sorted into solid trainloads for single destinations.

In view of the number and variety of terminal services, it is not certain whether it would simplify or complicate rate-making to make separate charges for all the principal ones. Certainly there is room for simplifying the present practice, which makes special charges in some cases (switching charges, etc.,) and none in others, and "absorbs" some of the customary charges. If the most important terminal services could be covered by a charge representing the long-run variable cost of the service, then "charging what the traffic will bear" would be confined to the haulage charge and the net result might be a desirable simplification of rate-making. The importance of the terminal element in expense is indicated by an estimate attributed to Commissioner Wooley, of the Interstate Commerce Commission, that one-third of all railway operating costs are terminal costs; while the varied character of these costs is indicated by a survey made of the terminals of Boston, showing that different movements require from five to nine single car moves, and cost from $6 to $12 per car. This includes an allowance for taxes and 6 per cent on investment, and these items make up 49 per cent of the total cost. The whole estimate is thought to lean toward liberality, but from it one may roughly estimate that two such movements cost as much as 100 miles of hauling.[1]

5. HAULAGE COSTS AND DISTANCE

The effect of distance on haulage costs is apparently one of the simpler elements in rate-making, yet the more one examines it, the less simple does it become. In a general way, cost undoubtedly increases with distance, yet in special cases it is not easy to trace the effect. It may be cheaper in some cases to haul a solid train to a junction point and then take a short haul back to an intermediate point, rather than carry the freight all the way to the intermediate point by the more expensive local train. However, this would only be true if the terminal movements at the junction were simple and the yards free from congestion.

Or we may take the case of a milk train which travels the length of a division, starting empty and arriving at the city with a full load. The cost of this train is governed chiefly by the maximum cargo it has to carry, and the first shipment it picks up costs little more than the last, though it may travel ten times as far. Thus, within the limits of the length of the division and of the capacity of one train, cost may be independent of distance. However, if there is so much traffic as to call for a number of trains, and some of them can make shorter runs if their cargo comes from nearer points, then distance begins to govern cost in a material way. Thus the system of making milk rates by zones of considerable width, disregarding distance within the limits of each zone, seems to correspond fairly to the facts of cost for this type of traffic.

Suburban passenger traffic is governed by somewhat similar conditions, except that here there are usually so many trains required that any material increase in the average distance traveled would increase the total volume of train movement and so increase costs. This suburban traffic is dense and regular, and hence cheap to handle, while its commutation tickets economize the labor of ticket agents, but it uses very expensive terminals, and there is a very real question whether it is not carried at a loss in view of the very low rates it enjoys and the heavy investment involved. A sample study of haulage costs and of terminal costs for large cities, small cities, suburban points, and country towns might yield very instructive and useful results.

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[1] Estimates reported by John C. Owers, *Railway Age* (August 19, 1922), pp. 337-39. They were criticized by the Interstate Commerce Commission in its decision in the Boston Wool Trade Association case, decided June 6, 1922.

6. ADAPTABILITY OF A "COST" SYSTEM OF RATES

If a system of rates were to be built on the principle of cost, would it be so rigid as to hamper reasonable allowances for commercial conditions? Not necessarily. In the first place, the principle of cost requires only that every class of business cover its own long-run variable costs, leaving a margin to be collected on the principle of "what the traffic will bear." This margin would be small for roads of dense traffic running through sections where production is well established, and does not need to be as tenderly nursed by rate concessions as in poorer regions. Where traffic is sparse and industry and commerce less firmly established, there would be sufficient margin for all reasonable concessions which might need to be made.

The rate system is naturally confined to certain objective facts or criteria on which rates and rate-differences are based. The first is covered by the classification. Different commodities may receive different rates, or the same commodity may receive different treatment according to the way in which it is packed and shipped. Here it is possible to take account of the special costs of loading and unloading, special care required in handling, risk of damage, and percentage of car-capacity which the traffic utilizes. This last could be fairly well taken account of by a uniform haulage charge of so much per gross ton-mile, since traffic which uses only a small part of the capacity of the cars or which forces the road to haul cars back empty, would be charged accordingly, and each ton-mile of paying freight would have a large gross ton-mileage charged against it for hauling the empty car.

Secondly, there is the size of the shipment. Differentiation on this ground is severely limited in the United Stares, under a long-established ruling of the Interstate Commerce Commission, recognizing the difference between carload and less-than-carload shipments, but no other. Yet in regions where certain products are staple, they move in large volume and are cheaper to handle for that reason, and as the forces of sectional competition center in these products, at least in the regions where they originate, the roads are impelled to give this fact recognition. This takes effect in the regional classifications, where the products in which each region feels a special interest receive lower ratings relatively than they do in the classifications of other regions. The most important ones receive still more elastic treatment through special commodity rates. This is one reason for opposition to a nation-wide uniform classification, and such a classification would, to some extent, discriminate sectionally against the products which move in heavy volume in each section, except as they were taken care of by means of commodity rates. While regional classifications may be inconvenient and undesirable they do not seem necessarily to violate the principle of cost.

The third objective fact on which rates hinge is the origin and destination of the shipment, and the distance covered. Here it is possible to make rates according to distance, either on a uniform mileage basis, or on a tapering scale, or by zones of different widths. Such scales might be used in various ways, as minima or maxima, or both. At present, more and more of the local rates are being fixed on such scales, while competitive points get lower rates than the local scales would entitle them to.

It is interesting that the system of express rates installed by the Interstate Commerce Commission in 1913 was based fairly closely (as analysis of the figures will show) upon a fixed charge for the shipment, a charge varying with weight, and a charge varying with the product of weight and distance.[1] Another interesting fact is that the system of charging what the traffic will bear commonly results in a tapering trend which might be called natural. Chart VI shows such a natural tapering trend in the rates on coal to towns in seven southern states.

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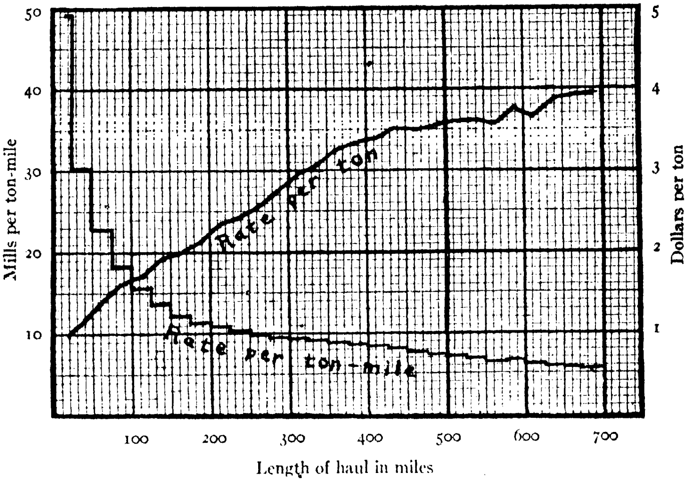
[1] See also A. S. Field, in the *American Economic Review*, III (December, 1913), 831–62, esp. p. 834.

An examination of this curve makes it seem probable that the longest hauls, and perhaps also the shortest, pay relatively little above the long-run differential cost of carriage, while the residual costs are distributed fairly evenly over the intermediate distances. In short, it appears to be the sort of curve that might be worked out by constructing a minimum scale based on long-run differential costs, and distributing a share of residual costs between the different distances according to what those distances would reasonably bear, and then smoothing the curve to avoid sharp breaks.

CHART VI



Trend of carload rates on coal from natural sources to all towns of 5,000 or over in Alabama, Georgia, Kentucky, Tennessee, North Carolina, South Carolina, and Mississippi. Hauls grouped according to distance and each group averaged. Data from statement of J. D. A. Morrow before Interstate Commerce Commission, January 19, 1922, Appendix, Part C. Published by National Coal Association, Washington, D.C.

It is impossible here to go into all the conditions affecting cost of service. These would include special types of cars, special loading equipment, expensive bridges and other structures, differences in topography, etc. All these would justify wide variations in charges. Nor is it possible to discuss all the problems and principles of rate-making, nor the many ramifications of the policy of "charging what the traffic will bear." A few points, however, may be touched upon.

7. SOME PRINCIPLES BEARING ON DISCRIMINATION

In general, the relation of cost to rate-making may be summed up as follows: Rates should cover long-run differential cost. For roads of dense traffic this is so near total cost that one might as well say that rates should be based on cost, as near as can be estimated without making the cost studies unduly burdensome. For roads of sparser traffic and higher costs, the same scale used by their more favored competitors might serve as a workable minimum, with leave to go below it in case of need, to develop traffic. Where two shippers or two hauls compete with each other in a direct way as, for example, the competition of eastern and western flourmills, which centers in the rates on flour and on wheat—differences in rates should be governed by differences in costs, even where absolute costs cannot be discovered.

In fact, the principles involved here are the same which have long figured in arguments between free-traders, urging a "natural" distribution of industry, and protectionists, urging a cultivated distribution. The key of the "natural law" argument is the doctrine of comparative costs, which requires the charge for transport to correspond with the cost of doing the work. Admitting the general argument, exceptions are urged for "infant industries" which require only temporary favors; to avoid destruction of "vested interests" (such as the manufacturing interests of New England, now working under a transportation handicap); to make sure of "key" industries which will bring others with them (if a railroad secures the building of a factory on its line it can count on large amounts of incidental and derived traffic); and to promote a socially and politically desirable distribution of industry. On these points the arguments over railroad rates and customs tariff parallel each other closely and departures from the rule of comparative cost are theoretically justified on these grounds, in both cases.

However, it is one thing to make special rates to develop traffic and another thing when the only result is to divert traffic from one line to another. Where rates are cut below the normal relation to cost, merely to secure existing traffic for this or that rival line, the efficiency of the transportation system as a whole is not increased by utilizing unused capacities, but more often diminished by routing traffic over roundabout lines when more direct ones exist.[1] Is there any justification for such tactics? Is the Interstate Commerce Commission right in sometimes allowing roundabout lines to take traffic from more direct ones without lowering their own intermediate rates to the level of the competitive through rates?

The question is not easy, but the principles we have been discussing offer some help toward its solution, suggesting an important angle of the problem which is not often clearly recognized. The roundabout route, which for that very reason usually has the sparser traffic, is in a difficult position, often the result of no fault of its builders. It is rather the victim of manifest destiny. After the most necessary roads have been built, others are needed, and are needed to tap other territory which is naturally not so rich as that occupied by the first roads. They are justified because of developing this new territory, but they cannot make a living from its local business alone without charging exorbitant rates. They are also useful in times of great business activity to serve as overflow routes for through traffic which it would ordinarily be cheaper to haul by the more direct route. They represent capacity available for the peak load, but partly idle most of the time.

This "readiness to serve" is of great value to the country's industry, but how can they collect an adequate reward for it? Certainly not by waiting till the congestion of the other lines forces traffic their way. This would give them a square meal once every two or three years, and leave them to tighten their belts between times. No; if they are socially justified, they have a right to a steadier income than this. A subsidy? Perhaps, if one could be agreed upon! Failing that, their handicap can at least be mitigated by letting them carry, in ordinary times, whatever share they can of the competitive through traffic.

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[1] This question is discussed by Ripley, *Railroads: Rates and Regulation*, chap. viii; and by H. G. Brown, *Transportation Rates and Their Regulation*, chaps. iv and vi; and by others.

This is wasteful, perhaps, viewing ordinary times by themselves, but they do not stand by themselves, and the burden involved is probably the cheapest form of subsidy. This argument would perhaps not fit all conditions, but it is of fairly general application. Regional consolidations would be a better solution of the difficulty, but failing that, the weaker lines may well be allowed a dispensation to meet the rates of their stronger rivals and secure a reasonable share of the competitive traffic.

This principle, however, would need to be very carefully applied in practice. Where two roads poach upon each other, each one stealing some of the other's natural traffic, no useful end is served, and the result is unmitigated waste. For this and other reasons, the direct lines should be held to a system of rates that does not violate the principle of cost. Then if a roundabout line meets these rates, it does not give the junction any advantage it did not already possess by virtue of distance. Being nearer the other end of the line than are intermediate points on the roundabout line, it gets a lower rate, and the intermediate points lose no advantage of geographical position, even if through traffic is hauled past their doors at a lower rate than they have to pay.

8. MAKING MONEY BY LOWERING RATES

One other question has lately been given a very significant emphasis. At the time of the agitation for the "Plumb Plan" for semi-public administration of the railroads, the advocates of the plan claimed that the roads could lower rates and that the reduction could be made self-sustaining because it would increase traffic, and the economies of increased traffic would make the roads better off with lower rates than they had previously been with higher. It was freely prophesied that, in a reasonable time, rates could be reduced 40 per cent by this method. The foregoing studies of cost should furnish sufficient answer to such claims. If traffic doubled in ten years or five, and rates were reduced 40 per cent, gross income would only increase 20 per cent, clearly not enough to pay for the added traffic. If traffic were trebled in fifteen years and rates reduced 40 per cent, total revenues would increase only 80 per cent. The increase in revenue would be 4 per cent for every 10 per cent increase in traffic. But, as we have seen, the long-run differential cost of this traffic would be far more than four-tenths of average cost: it would be more nearly twice that amount, and the reductions could not possibly be made self-sustaining.

One case could be cited in support of this plan for reducing rates. During the depression of 1921 the Interstate Commerce Commission, with the virtual acquiescence of the carriers, ordered a reduction of rates in the hope of stimulating a revival, or at least to avoid stifling it by maintaining rates which business could not pay and prosper. The experiment appears to have been justified by the outcome: traffic and earnings have revived, and an observer might infer that the reduction was good for the treasuries of the roads.

But it is one thing to help regain ground lost during a depression, and to start the cumulative forces of revival on their way; and it is quite another thing to attempt to develop such an increase of business as the Plumb Plan argument called for. In the case of a depression hanging on the edge of revival, small causes may produce large results rather quickly; in the other case large causes might produce very slow and disappointing results. Moreover, in 1921 the roads had large amounts of unused capacity, so that the added cost of added business was at a minimum, and the economy of increased traffic at a maximum. Variable costs may have been about 40 per cent of average costs, or even less. But with such a sustained growth of traffic as the Plumb Plan contemplated, more capital would be required, and the added costs of added traffic would go up by leaps and bounds, reaching three-quarters of average costs at the very least. This would preclude any possibility that large reductions of rates could pay for themselves by the economies resulting from the increased traffic they brought forth. This claim can only be plausible so long as no serious attempt is made at quantitative reckoning of the added costs due to added traffic.

9. CONCLUSION

We have here considered only a few aspects of the relation of costs to railroad rates. However, a comprehensive treatise on railroad rates is not part of the task of this book, and we must pass on to a brief consideration of the transportation system as an organic whole, including railroads, streets and highways, and waterways.

CHAPTER XV

THE TRANSPORTATION SYSTEM AS A WHOLE

SUMMARY

The size of the transport industry, 298—Economic problems involved, 302—Some questions of highway economy, 304—Highways versus railways, 307—Benefits of improved highways, 309—Inland waterways and overhead costs, 311—Conclusion, 316.

1. THE SIZE OF THE TRANSPORT INDUSTRY

The people of the United States probably spend not less than one-quarter of their annual economic income on transportation. And presumably not less than one-quarter of the country's productive energy takes effect in moving people and commodities from place to place, though much of this energy is not directly engaged in the work of haulage. It includes a large share of the mining of coal, the refining of gasoline, the making and repairing of vehicles, and other forms of manufacturing tributary to the transport industry. Under most circumstances these would be classed as extractive industry and manufacturing, but for the present purpose the essential point is that their results are utilized via transportation, and their effectiveness in actual service is made or marred by the effectiveness with which the results of all this outlay are put together in the work of moving the American people and its goods. This transport bill, huge beyond the power of the mind to grasp the meaning of figures, is one of the incidental penalties of our industrial greatness, resulting from free intercourse over continental areas and great concentrations of production, with all the efficiency which these things bring with them.

The avenues of transport may be broadly classified into streets, country roads and paved rural highways, steam railroads and street and interurban electric roads, improved rivers, canals, the Great Lakes, and the ocean with its arms and harbors, while the air may have to be reckoned with in the near future.

The total investment of capital involved in transport has been estimated at $50,000,000,000, including approximately $20,000,000,000 for railways and nearly as much for highway transport, $5,000,000,000 for electric railways and a little less for inland waterways and marine transport.[1] The estimate for highway transport omits city streets and all unimproved roads, but the same authority puts paved city streets at $4,000,000,000. While the magnitude of highway transport is significant, more significant still is its recent and enormous growth, for it has multiplied between five and sixfold in a decade and is still growing rapidly, while railroads have remained relatively static during the same period. Clearly we have to adjust ourselves to a revolution in transportation. A modern motor highway may cost $20,000 per mile or more equal to the cost of the early canals and comparable with costs of way for single-track railroads. As a result highways have outgrown former methods of financing.

In 1921 there were in this country about 9,000,000 passenger cars and nearly 1,000,000 trucks,[2] the average wholesale value new being something over $750.[3] Allowing for retail values less depreciation, $7,000,000,000 would not be an extravagant estimate of the investment involved, since the average age of the cars is far less than half their normal life, on account of the rapid increase in production. These vehicles move on improved roads which have been estimated to represent an investment of more than $4,500,000,000, paved streets representing some $4,000,000,000 more, and unimproved roads representing an uncertain but very substantial investment.[1] Garages, etc. (the equivalent of railroad shops, roundhouses, etc.) represent a further investment running into billions. Thus it seems fair to conclude that the investment in roads, streets, and stationary equipment far exceeds that in vehicles.

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[1] See estimate by J. Rowland Bibbins, United States Chamber of Commerce, Department of Transportation and Communication, *Our 50 Billion Dollar Industry.*

[2] The most careful and enlightening statistical study of the automobile industry which has come to the writer's notice is a pamphlet by Leonard P. Ayres, of the Cleveland Trust Co., entitled *The Automobile Industry and Its Future*, 1921 (The Cleveland Trust Co.). The total registration of cars and trucks in 1921 was 10,448,632, but something like 500,000 should be deducted for cars going out of use during the year, as Mr. Ayres's study indicates, though his study does not include the 1921 figures.

[3] *Facts and Figures of the Automobile Industry*, issued by the National Automobile Chamber of Commerce, 1922, shows the average wholesale value of the 1921 output to have been $756, being $723 for passenger cars and $1,080 for trucks.

It will, perhaps, be worth while to make up parallel budgets of investment and expense for rail and motor transport, even though the figures for motor transport necessarily contain too much guesswork to be entitled to scientific standing. Suffice to say that the total economic outlay for motor transport clearly exceeds that for railroads, and is divided in very similar proportions among the main items of maintenance and interest on way and structures, and maintenance and operation of the moving equipment. The chief difference is that "maintenance of equipment" for motor vehicles is high, while the cost of "conducting transportation" may be correspondingly low. The main heading of "Maintenance," in the railroad accounts, includes depreciation, and depreciation on motor vehicles is heavy, since their average life is less than six years.[2] Depreci-

TABLE II

	Railroads, U.S. Class I, 1920	Streets and Highways
Maintenance of way and structures, including depreciation	$1,032,540,381	$900,000,000
Maintenance of equipment, including depreciation and conducting transportation	4,494,450,891	6,000,000,000†
Total operating expenses	5,827,591,146	6,900,000,000
Interest on way and structures	750,000,000*	500,000,000
Interest on equipment	375,000,000*	420,000,000
Taxes	272,061,453	257,000,000‡
Total economic sacrifice	7,224,052,599	8,077,000,000

* This interest is roughly estimated. A large part of it was not earned in 1920. This year shows railroad costs at their greatest. They have since shrunk, while highway traffic and costs have gone on expanding.

† 9,000,000 passenger cars at $500 per car, and 900,000 trucks at about $1,500 per truck would produce this figure, which thus appears quite conservative, especially as one operator has asserted positively that the total expenses of trucks alone were at least $3,500,000,000.

‡ These taxes go toward maintenance, but the *non-industrial* functions of government have a fair claim to this much support, and if these are deprived of it, the deprivation is a sacrifice.

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[1] Estimates of Mr. J. R. Bibbins of the United States Chamber of Commerce, Department of Transportation and Communication.

[2] See pamphlet by Leonard P. Ayres already referred to.

ation on roads furnishes a problem, for roads appear to wear out in ten or fifteen years; but since about half the investment in a highway is permanent and not subject to depreciation, the burden need not be more than 3 per cent to 4 per cent, where roads are properly built in the light of present engineering knowledge. As for interest, railroad capital should yield 6 per cent, while highway bonds pay considerably lower rates, but apart from this difference the interest burdens would not be very different, since the investment in both fixed and moving equipment appears to be strikingly similar in amount.

The costs of the railroads are taken at their highest point, while the figures for highways are intended as conservative estimates. Of the two, highway costs are expanding far the faster.

If the costs of these two great branches of transportation correspond so closely, how do the services rendered compare? It is estimated that motor trucks carried, in 1921, 1,430,000,000 tons as against 1,642,251,000 tons for the railroads, the average haul being about 4½ miles and the ton-mileage about 6,500,000,000 as against over 300,000,000,000 for the railways.[1] As the capacity of the average freight car is probably more than twenty times that of the average motor truck, and there were more than two and one-half times as many freight cars as motor trucks, it appears that the motor truck accomplishes about the same ton-mileage per ton of capacity as the freight car.

Passenger traffic by motor car can only be guessed at. One estimate places the number of passengers carried at nearly 7,000,000,000, against 1,000,000,000 for the railways, and the passenger-mileage at over 70,000,000,000, against 37,000,000,000 for the steam roads.[2] Electric railroads carried 13,000,000,000 cash and 3,000,000,000 transfer passengers. Apparently motor cars do not produce as large a physical volume of service as railways, but on the other hand it is reasonable to reckon the value of the service per ton-mile or per passenger-mile at a higher figure than the service rendered by rail carriers, so that there is no reason for supposing that our highway traffic as a whole is not worth what it costs the country.

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[1] *Facts and Figures of the Automobile Industry* (p. 7) quotes these figures on authority of the United States Bureau of Public Roads.

[2] This estimate is made by the National Automobile Chamber of Commerce in the pamphlet, *Facts and Figures*, already referred to.

As for inland water traffic, it is of very different kinds. The Great Lakes carry a huge tonnage of coal, ore, and grain, offering probably the cheapest carriage in the world, and the overhead cost of harbor and channel improvements, including the Sault Ste. Marie Canal, are small in proportion to the total benefit. The lakes, moreover, are open for traffic during the September-October peak, and thus afford relief from what would otherwise be intolerable congestion in the great east-and-west rail routes which parallel them.[1] Inland rivers and canals, however, carry a small aggregate of traffic, and the overhead cost of channels and other works constitutes, in proportion, a very heavy burden—one that would be prohibitive in most cases if it were laid as a charge on the traffic. The Monongahela River is a notable exception, carrying large volumes of coal direct from river mines to the waterside plants of the Pittsburgh steel district in fleets of barges mainly owned and operated by the large steel and coal companies.

2. ECONOMIC PROBLEMS INVOLVED

The economic questions arising out of this vast and imperfectly co-ordinated system of transportation are many and various, and some of the most difficult ones center in economizing overhead costs and raising them in a fair and satisfactory manner. We have two systems at work. In one the way is publicly built and maintained and its use is free to all, so that traffic need bear only the costs of "conducting transportation" and the overhead burdens of the vehicle and its accessories, unless special taxes, tolls, or fees are charged beyond the usual taxes on productive captial. Here the decision to build the highway, and what kind of a way to build, is made through political machinery and subject to political forms of influence, without, in most cases, a really adequate economic survey of costs and benefits.

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[1] In the case of railways which serve as feeders to the boat lines, lake traffic probably does not make the seasonal peak either much better or much worse.

Moreover, once the way is built there is, or has been so far, very little control over the use or abuse that may be made of it by the traffic.

In the other system, way and traffic are both in the hands of the same company. The way is built for just the traffic which the company intends to move over it and the traffic is adjusted to the way. A railroad will not buy the heaviest locomotives if its rails and roadbed will not bear them without undue damage, but an overloaded truck will go wherever it is allowed, and the damage it may inflict is a matter for the trucks which follow and for the public which maintains the roads. And rail traffic pays not only the expenses of carriage but maintenance, depreciation, and interest on the way, together with taxes to support the general work of government.

It is clear that under the first system there is more chance for waste, and for transportation which is really parasitic. So far as the two systems co-operate with each other and this is their chief relation this problem of waste creates no further difficulties. But where the two systems compete, there is a question of fairness as well as a possible added waste from diverting traffic to the more expensive route.

Added to this is the fact that modern motor traffic has required revolutionary changes in road construction, and engineers are still learning what are the best foundations and surfacings, what loads different types of road will stand and what kinds of wear or impact cause failures, how long roads should last and under what traffic conditions, and how much a worn-out road is worth for purposes of rebuilding. The relative value to the traffic of different types of road is another thing requiring careful study. Not every road can be of the best quality, for the country could not pay the cost. Last, but not least, there are questions of financing. How much can be raised, and what should be done if it is not possible to raise as much money as should, in the interests of efficiency, be spent? Should special assessments, general taxes, or bonds be used or should special taxes on the transport industry be used to pay the interest on the bonds and amortize the principal? What should be the term of the bonds and the provisions for retirement? How should the burden be divided between towns and cities, counties, states, and the federal government?

All these troubles, and more, arise from the fundamental fact that the way is built by the public and thrown open freely to private use generally to unlimited use. Most of these issues would disappear if the same body which built the road also operated the vehicles and collected the revenues from them. Yet no one would seriously propose to operate highways on this plan: the right to use them freely is one of the last refuges of personal liberty. Hence these difficulties must be faced and somehow answered.

3. SOME QUESTIONS OF HIGHWAY ECONOMY

Let us look in more detail at some of the problems of highways. Here the paradox of overhead costs assumes an extreme form. Before a road is built, it is rational to say that the traffic which benefits should bear the overhead cost and that if it cannot bear it, the outlay is probably not justified.[1] But once a well-paved road is built, reasonable use costs nothing at all, and any charge which limits the amount of such traffic would result in unused capacity and the loss described by the phrase, "idle overhead." Yet certain kinds of traffic do break down the roads, and should pay accordingly or be prohibited. The most effective avenue of prohibition is via the manufacturers of vehicles, yet to set a fixed limit on the weight of trucks would be clumsy and inappropriate, for in congested cities and places where traffic is dense, it is economical to build a way that will stand the pounding of the heavy truck, while in country districts the cost would be prohibitive. Thus the logic of the situation points toward two policies: The first is to lay the overhead costs of streets and highways so that they will fall on the users, but *not solely or chiefly as a direct cost of use.* Rather it should still take the form of an overhead charge, such as an annual license fee. A moderate tax on gasoline might also be justified, especially as there are still some highway costs which vary with the general volume of travel, but if the tax were made heavy enough to raise a large part of the highway overhead, it would check traffic whose "variable cost" to the public would be far less than the tax. Moreover, it would not distinguish between a heavy truck and a number of light passenger cars, according to their proper shares of the highway overhead cost.

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[1] This statement clearly needs qualification, since it is well recognized that no system of tolls could collect all the benefits of such an improvement. The thing which economists have called "consumers' rent" *may* justify construction.

The second indicated policy is to control the weight of vehicles so that heavy hauling can be done where traffic justifies building heavy roads, while at the same time less expensive roads can be used where traffic does not justify the heaviest construction, without being destroyed by weights too great for them. This offers an administrative problem of some difficulty, but the thing can be done if it is regarded as sufficiently important. That is, sufficient control can be established to protect the highways, though it would never be possible to catch every case of overloading.

Different types of road are damaged differently by use. With asphalt the surface ripples; with concrete, the slab cracks under impacts. This cracking appears to be due to the one maximum impact rather than to the cumulative effect of a series of lighter blows.[1] This maximum impact depends on a number of factors, including the tires (pneumatic tires produce far less shock than solid rubber, and naturally do not lose their cushioning virtue with age in the same way) and also the distribution of weight on the wheels (most trucks concentrate too much weight on the rear wheels for the good of the roads).

To the extent that concrete becomes the accepted form of improved motor highway, it would seem that highway costs are governed in large part by the weight of the heaviest loads. Some main routes require extra widths on account of the number of vehicles, and here the whole width must, of course, be made strong enough for the heaviest loads carried, even though a narrower road would accommodate all the heavy vehicles.

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[1] See *Public Roads*, November 1921, pp. 4-5. Published by United States Department of Agriculture, Bureau of Public Roads.

Responsibility here is joint. However, where traffic is as dense as this there is little question but that the benefits are worth the overhead outlay required, unless the cost is exaggerated by letting the roads be pounded to pieces.

The heavy truckload means a saving in overhead costs to the operator, but may impose a far heavier burden on the community. Mr. Mackall, chairman and chief engineer of the Maryland State Roads Commission, has described the war-time experience of the Baltimore-Washington highway in these terms.[1]

> In 1917–18, that road carried a tremendous traffic, not so great in number of units as in size of units. For practically its entire length in April, 1918, it was impassable. It could not be used for anything except very light trucks. The cost of rebuilding that road in 1918 was $600,000. A traffic count was taken for the twelve months preceding reconstruction. It was not accurate but was approximate. A comprehensive study was made of that traffic count and it was demonstrated by the Bureau of Public Roads, in a statement which they published, that if all the units of 5 tons or larger had been carried on units of 3 tons, taking the manufacturers' rated efficiency, the cost to the operators would have been $15,000. The people of the state of Maryland paid $600,000 to permit a few truck operators to save $15,000.

Whether these figures justify the exact conclusion drawn or not, the principle is valid. Apparently it would be cheaper, as well as more merciful to the trucking business, to enforce limitations on the size and loading of trucks, rather than to attempt to collect fees equivalent to the burdens which the heaviest loads impose. One mitigating feature is that when a concrete road is rebuilt, the old concrete remains as foundation and the result is a thicker, stronger road than before, at far less than the original cost of construction.[2] In the past, it has been estimated, motor highways wear out in from ten to fifteen years, but their life should be greatly lengthened in the very near future, partly by control of traffic, partly by better construction and partly by the strengthening and consolidation that comes with repeated rebuildings. It is an engineering possibility to make highways which should be virtually everlasting—at a price.

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[1] *Conference on Economics of Highway Transport*, published by Highway and Highway Transport Education Committee, Washington, D.C., 1922, p. 19. Would the result have been as striking had the count been made earlier?

[2] Charles Whiting Baker estimates that the old structure may be worth as much as three-eighths of its original cost as foundation for a renewed surface. See *Engineering News-Record*, July 10, 1919, p. 55. Grading, of course, is virtually permanent.

As for methods of financing: special assessments on land receiving special benefits, license fees on vehicles, and gasoline taxes, all have their uses. For some special routes, the old-fashioned toll-gate has its virtues, where there is no ordinary community intercourse to be interfered with and no very vital community interest in promoting traffic. Bonds are an appropriate device for synchronizing cost and benefits, if their term is no longer than the life of the road. However, the bonds should not be a charge on the general revenues of the state, which are badly needed to meet other growing needs. Even the special assessment has its injustices when it covers the entire cost of improvements which benefit motorists exclusively. The non-motorist landowner has a just grievance. Special assessments and vehicle and gasoline taxes should rather divide the burden between them both in city and in country.

4. HIGHWAYS VERSUS RAILWAYS

Where these two systems of carriage come into competition, the one which has to pay its own overhead costs out of charges on the traffic naturally feels that the competition is unequal and unfair, though no objection was raised to the principle of free highways so long as they served merely to feed traffic to the railways, not to haul it in competition with them. The shortness of the average haul by motor truck (4½ miles) is proof that the great bulk of motor haulage is still strictly local and does not compete with the railroads. The volume of competitive traffic is relatively small, though actually large. The chief sense of rivalry is probably felt over motor freight lines hauling goods over distances from 25 to 80 or 100 miles, and passenger lines operating over shorter average distances.

The natural field of the motor truck lies in what would be less-than-carload business if it moved by rail, requiring a truck haul at each end of the trip and four handlings or more. The truck can substitute one long haul with two handlings for three short hauls with four or more handlings, and furnish far greater speed and reliability into the bargain. On the other hand, the operating cost of the truck is high—probably not far from 20 cents to 25 cents per ton-mile for the type of truck engaging in this business,[1] as against what is probably considerably less than 1 cent for comparable railroad expenses. Thus it appears that the truck has a decisive advantage on the short hauls, and the railroad on long hauls. An increase in the charges on trucks would shorten the distance at which the truck could compete, but could not eliminate it, without eliminating at the same time most of the non-competitive haulage. If the highway overhead properly chargeable against trucks is kept within bounds by not allowing the trucks to inflict undue damage upon the roads, the remaining problem will not assume very serious proportions.

Fair charges for interest and maintenance of highways may be roughly estimated at less than one-fourth of the total vehicle costs (including interest, maintenance, and depreciation on the vehicles), and the vehicles are already bearing a part of this (though not a major part) in the shape of taxes, license fees, etc. The trend of development seems to be toward a reduction of needless highway overhead and an increase in the burdens falling on the motor-user, chiefly for other reasons than the unfairness of subsidized competition with railways. Furthermore, the railroads may possibly feel this competition more intensely than its long-run effect on the earnings would justify (especially with rates regulated toward a 6 per cent return), for they are naturally inclined to take the standpoint of a road which, for the moment, has unused capacity rather than that of a road which would, in the long run, have to add to its capital investment in order to handle the traffic now going by motor.

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[1] Cf. Charles Whiting Baker, in *Engineering News-Record*, July 10, 1919. On a pre-war basis, he estimated costs of hauling farm produce over country roads at 25 cents per ton-mile, and motor-truck costs at from 12 cents to 25 cents. One estimate gives 58.4 cents per truck-mile for a 5-ton truck running 50 miles per day for 300 days in the year. This seems a high performance. Another estimate gives $23.15 per truck-day plus 14 cents per truck-mile, or about 24 cents per ton-mile, if there is an empty haul one way. Mr. Pride, a motor-truck operator, has estimated the total expense of motor trucks at $3,500,000,000 per year, which would mean over 50 cents per ton-mile. Much of this is in light loads, however. See *Conference on Economics of Highway Transport* at the University of Maryland, July 27, 1921, p. 29.

If there is a social interest in the case, not represented by the bare facts of cost, it probably lies in the fact that highways have a value as an emergency system of carriage in case railroads are paralyzed by strikes or other difficulties. They can reduce what would otherwise be an absolute danger to the life and health of the people to the proportions of a serious loss and inconvenience. It is probably not a healthy thing for the community to be so exclusively dependent upon steel rails, locomotives, and the negotiations between railroad managers and railroad brotherhoods. The highway, by its very lack of co-ordination, is difficult to paralyze a valuable compensation for the serious wastes which this lack of co-ordination involves. There is an element of truth back of the popular feeling that the railway has the people at its mercy, while the more individualistic means of transport are their servants.

5. BENEFITS OF IMPROVED HIGHWAYS

The real question is of the quality of roads, rather than their quantity, and the more urgent needs for improved roads can be gauged by the character and volume of traffic which makes its way against the difficulties of the roads in their unimproved state. The benefits of good roads should be at least equal to their total cost. These benefits may be figured at the actual saving in costs of haulage on the previous traffic plus part of this same difference on the new traffic brought into being by the new roads. One survey estimates that improved roads in eight counties have reduced hauling costs from 33.5 cents per ton-mile to 15.7 cents per ton-mile on the average, a saving of 17.9 cents.[1] This saving was multiplied by the total traffic as indicated by a traffic survey after the improvement of the roads, and from this total was subtracted the interest and amortization charges on the highway bonds. In seven out of eight counties covered by this study, the result showed benefits in excess of costs.

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[1] United States Department of Agriculture, *Bulletin No. 392*, October, 1916, p. 8.

This estimate is subject to three criticisms. The saving per ton-mile is exaggerated in the case of traffic developed by the new roads. Since this traffic would not stand the former cost of haulage, the total benefit would be the difference between the present cost of haulage and the largest cost the traffic in question would stand. This would reduce the saving on this new traffic by probably about half. In the second place, nothing is charged for maintenance, though the new roads require substantial maintenance and the old ones received hardly any. Thirdly, in place of the amortization charges on the bonds the true charge should be the depreciation of the road itself. A forty-year bond with a sinking fund may show a very low amortization charge, but if the road wears out in ten years, the saving is purely imaginary. Allowing for all these factors it becomes more doubtful if the average county shows more benefits than costs or more costs than benefits, in direct savings on goods hauled.

However, there are intangible benefits.[1]

> Before the roads were improved the average school attendance was 66 pupils out of each 100 enrolled, as compared with 76 after the roads were improved. . . . . Not only have the roads contributed toward a larger school attendance, but they have been quite instrumental in lifting the standard of instruction by making easier the consolidation of little one-room schools into graded schools. In Dinwiddie County the system of taking the children to and from schools by means of wagons has been adopted since the roads were improved.

Then there is the promotion of community intercourse, and other possible intangible values, which justify giving good roads the benefit of the doubt.

Another way of measuring the benefits is by the increase of land values. This is quite unreliable, however, since it is impossible to distinguish the increase due to roads from that due to other causes. The tendency is to credit good roads with the entire benefit resulting from the progress of the community.

There is one important qualification on the principle that the service rendered by roads should equal their total cost. It has become a commonplace that one of the most promising remedies for unemployment is to use public works, such as roads, as reservoirs of employment and push them more rapidly when the volume of employment elsewhere is low. And it has been suggested in an earlier chapter that the differential cost of such work to the community is very little, if the only alternative is idleness. Accordingly it might be sound to charge part of the cost of roads to prevention of unemployment, if they are actually used in this way, and if there is not enough work which can be so used and whose direct benefits are worth its full financial cost.

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[1] From the bulletin cited above.

However, under ordinary conditions it should be possible to find all the work necessary in improvements which are fully worth their cost, especially as, in proportion as the policy succeeds, it will tend to reduce the strain put upon it. Providing work for 100,000 workers would naturally tend to diminish unemployment by considerably more than that amount. Unless it is absolutely impossible, all work should meet the test of creating a product worth its total cost. But if this cannot be done, then work which could not meet this test might still be worth its differential cost to the community, and deficits might rationally be charged against prevention of unemployment as a species of collective overhead cost of industry as a whole. Road-building which is actually used in this way would, on these conditions, be economically justified. Or, put it the other way around, if we are going to build roads which cannot show traceable benefits equal to their cost, they can be furnished with an adequate reason for existence by utilizing them as eveners of the curve of unemployment.

6. INLAND WATERWAYS AND OVERHEAD COSTS

The proper place of inland waterways in our transportation system is a subject of much dispute, in which a correct reckoning of overhead costs is essential to any logical decision. All that can be done here is to point out the general principles involved, and some of the difficulties in the case. The waterway is like the highway in that, after an improved channel has once been built, any tolls charged for its use would prevent some traffic from moving, while the variable cost of the traffic would be practically nothing. Since there is such great difficulty in stimulating tonnage to move by water in any case, it becomes practically out of the question to charge tolls on canals or improved rivers. Thus the waterway is relegated to that somewhat hazy borderland where economic justifiability rests on demonstrating that benefits exceed costs, even though it is impracticable to make them prove it by paying cash.

Here there are many chances for error. Both cost of construction and volume of traffic are harder to prophesy than in the case of roads, where existing traffic and similar roads offer fairly good evidence. With an overestimate of traffic goes an underestimate of the burden of overhead costs per ton-mile, and also of the added burden of the larger and deeper channels which have been so much urged of late years as a cure for the ineffective state of inland waterways. There is also a tendency to overestimate the capacity of a waterway, calculating both capacity and costs on a basis of steady operation at full theoretical capacity for both waterway and boats and barges. This exaggerates the performance of the boat and thus minimizes the burden of its overhead costs if, indeed, they are taken account of at all. Costs of water haulage and terminal handling are often estimated on the basis of operating expense alone, which, of course, fails to include the necessary return on the carrier's investment.

These errors are serious: some of them may make a difference of several hundred per cent, and they have a way of combining with each other by multiplication rather than addition, so that the result is sometimes startling. For instance, if actual cost of constructing a canal exceeds the estimate by 50 per cent, and the traffic is only 25 per cent of the estimates, then the channel overhead per ton-mile is six times the estimates. Then if the performance of a towboat and fleet of barges is estimated on the basis of too few barges, there is an underestimate of floating overhead, and if the performance per towboat is estimated on the basis of a theoretical capacity which is three times what is actually achieved, then the floating expense per ton-mile of traffic will probably turn out some three times the estimate. And if the season's expense per towboat is 50 per cent more than the estimate, the cost of traffic will be, not three times the estimate, but four and one-half times.

In estimating the capacity of a canal or canalized river, the locks are the limiting factor, and the crucial thing to remember is the fact of variability. The number of vessels wishing to pass a given lock will not be distributed uniformly throughout the day nor through the season, nor will they all use the full capacity of the locks. If the traffic per day averages two-thirds the rate of the busiest hour, and the traffic per season averages two-thirds the rate of the busiest day, and the average craft uses two-thirds the capacity of the lock, then the canal will begin to be congested when the traffic is at eight twenty-sevenths of its theoretical capacity, estimated on the basis of uniform operation. Traffic can be pushed beyond this, but only at the cost of delays which will result in an insistent call for more capacity. In these respects local conditions differ. On the Monongahela River tows are very uniform in size, and the standard tow uses the full capacity of the locks, but on the New York Barge Canal this has been far from the case. Most of the barges are still the same which plied the old canal, their capacity being 240 tons, though vessels of 1,500-ton capacity can and do navigate the new channel.[1] Even where tows are made up which utilize the full length and width of the locks, the available depth is not fully exploited. This condition may prove to be temporary, though numerous shippers of moderate size will probably always find the smaller craft more economical than the larger.

As for depth of channel, the author once analyzed estimates of the cost of construction and operation of a 9-foot and a 12-foot channel and found that, accepting these estimates as correct, in order that the saving from the deeper channel should pay the extra overhead cost involved in its construction, the traffic must not merely utilize nearly the full capacity of the canal, but must utilize it uniformly with boats which require the extra draft.[1] This is a condition which practically no waterway could meet. Indeed, one handicap under which the modern waterway labors is that, in order to utilize the capacity of a channel of 9 to 12 feet, tows of several thousand tons' capacity must be employed, and few shippers can fill these with regularity, except the large steel and coal companies. Smaller concerns have to choose between smaller craft, or "idle overhead" in boats and terminals, or the use of someone else's vessels, which generally means an extra haul to the loading-point, and an extra handling.

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[1] See *Report, New York Superintendent of Public Works on Canals*, 1921, pp. 14-16

This matter of terminal costs is probably the chief reason why inland water traffic has developed in disappointingly small volume. Most manufacturers can secure a spur-track connection with a railway and ship carload lots, but relatively few can reach a waterway without a haul by truck. Furthermore, a 40-ton car is one thing and an 800-ton barge another, while a tow-load of 1,500 to 5,000 tons is equal to an entire freight train, and most plants cannot furnish such quantities. Thus the natural candidates for water traffic are the smallest and the largest shippers—the less-than-carload shipper, who must stand a truck haul in any case, and the shipper of trainloads. Those in between have a natural affinity for the carload shipment by rail. On many of our inland rivers, terminal costs are increased by the need of providing for a rise and fall of 50 feet, or even more at times, in the level of the water. This matter of terminal costs is one of the reasons why the friends of waterways are continually disappointed in the volume of traffic developed.

In this brief sketch the writer has for the most part avoided citing concrete cases[2] and has striven merely to show the importance of overhead costs and some ways in which they can easily be underestimated. In concluding, it may be of interest to present in parallel columns an estimate of total cost for a railway and a waterway, each to be built new, at pre-war prices, each to be 250 miles long and to haul 20,000,000 tons of freight. The costs in cents per ton are estimated as follows:[1]

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[1] The estimates in question were utilized by the Lake Erie and Ohio River Canal Board, with reference to the Beaver-Ashtabula project.

[2] H. G. Moulton's *Waterways vs. Railways* furnishes a mine of illustrative material on this subject.

	Waterway	Railway
Maintenance of way (including depreciation)	11.00	8.60
Maintenance of equipment (including depreciation)	7.50	14.85
Transportation	13.44	20.00
Traffic and general	1.69	2.00
Taxes, insurance and damages	3.90	6.41
Interest on way	27.50	6.76
Interest on equipment	4.69	4.35
Total	69.72	62.97

The decisive items in the comparison are interest and maintenance of way, since these together constitute the overhead cost borne by the public. These two items come to over 55 per cent of the total waterway cost, and would be more if the tonnage developed proved smaller than the estimate. Eliminating these two items from both columns, the waterway would cost only 31.22 cents, against 47.62 cents for the railway, or about two-thirds the cost by rail.

To take a specific case, the items of interest, depreciation, maintenance, and operation on the New York Barge Canal amount to a sum which is probably about $12,000,000, or more than $8.00 per ton of freight moved in 1921.[2] This counts the investment in the new canal only, and credits the new canal with all the traffic it now carries, though its tonnage is not yet equal to that carried by the old canal at the time it was closed for the building of the new one.[3] This places a heavy burden of proof on those who hope that the canal may show benefits equal to its cost. The difference between rail and water rates on grains apparently amounts to the equivalent of about 40 cents per ton, while on class freight the difference may average over

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[1] Based on a table in report of Special Board on Canal Connecting Lake Erie with Ohio River, 67th Congress, 22d Session, *House Doc. No. 188*, p. 30.

[2] Data on investment, tonnage, and operating expenses from reports of New York Superintendent of Public Works. Interest plus depreciation reckoned at 6 per cent on $170,000,000.

[3] Based on figures for 1921.

$2.00.[1] Traffic must increase greatly before the canal can show a real economy.

One further benefit which has bulked large in the minds of those responsible for waterway construction is the reduction of rail rates by water competition. This method of controlling rail rates, though expensive, is effectual, and may have been worth its cost in the days before the Interstate Commerce Commission acquired its present powers over the general level of railroad earnings and before the size and cost of waterways grew to its present huge proportions. Now, however, with rail rates regulated toward a general level yielding 6 per cent on investment, the chief effect of water competition is to cheapen some hauls at the expense of others, creating differentials in favor of localities which benefit from water competition, actual or potential. It is more than doubtful whether any community benefits which arise are worth the heavy overhead cost.

In general, a modern large canal capable of carrying 1,000-ton barges or 3,000-ton tows, costs several times as much as a railway of similar capacity, so that its disadvantage in overhead cost, coupled with terminal handicaps, is likely to be decisive.

7. CONCLUSION

It is quite possible to have an adequate and economical transportation system, in spite of the difficulties created by the laying of overhead costs on the public treasury. There are several essential requirements of a sound policy. One is careful and conservative surveys of costs and benefits before deciding on construction. Another is control of traffic so that it may not be necessary to build wastefully heavy roads in order to avoid wastefully heavy wear and tear. A third is that burdens should fall where the benefits accrue, largely in the shape of yearly fees, but partly in charges varying with use, so that this essentially industrial service of government shall not, under the increased demands made by motor transport, eat up the revenues needed in ever increasing amounts for non-industrial services which cannot as fairly be made self-supporting as the highways. And lastly, highway bonds should obviously not outlive the highways, if ordinary foresight and caution can prevent this, and in any case the cost of roads should be charged with the depreciation which actually occurs, not the amortization charges on the bonds. With this brief survey of problems of overhead cost in transportation, we must now turn for a moment to another class of industries where problems of overhead cost appear in an even more interesting and characteristic form, namely, the "public utilities."

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[1] Based on figures given in bushels and 100-lb. units in *Report of New York Superintendent of Public Works, on Canals*, 1921, pp. 10 and 20.

CHAPTER XVI

PUBLIC UTILITIES

SUMMARY

Introduction, 318—Economies of size, 318—Load factors and the allocation of costs, 322—Service and rates, 323—Building ahead of demand, 330—Fair return and the incentive to efficiency, 332—Conclusion, 334.

1. INTRODUCTION

The term "Public Utilities" is commonly applied to companies furnishing a community with such things as water, gas, electric current, or telephone service. Street-car lines are also included, but will not be discussed here. These services exhibit all the problems of overhead cost, and in extreme forms. They have large capital investments, of a highly specialized kind; they show marked economy with size (except for telephone companies) and with intensive exploitation of their localities; they have strongly marked daily and seasonal peaks and some of them have developed definite policies looking toward minimizing the wastes involved; and they face difficult questions in allocating their overhead costs to different types and classes of business. In the sale of electric current, in particular, there have been developed the most systematic mathematical methods found anywhere for differentiating charges according to factors affecting the company's peak load. These systems of rates involve principles deserving of serious study by other businesses, with a view to adapting them to their own peak-load problems.

2. ECONOMIES OF SIZE

The causes of increased efficiency with increased size in the supply of electric current are admirably summarized by Paul M. Lincoln, who groups them under three main heads.[1] First is the fact that larger units of equipment cost less per unit of capacity; second is the reduction of operating expenses, and third is the fact that the greater the number of customers, the more do their individual irregularities neutralize each other, producing a better load factor for the plant as whole than the average of the individual load factors, and a better load factor for a large plant than for a small one. Over against these savings stand the elements of increasing cost in the distributing system, and increasing losses in transmission. The reduction of operating expenses is partly due to the fact that larger output makes it economical to instal more and more labor-saving devices, and in order to secure these gains investment must increase more than would be necessary merely to reproduce on a large scale the identical mechanical units and the identical physical services rendered by smaller plants. And as a further result, operating expenses per unit produced diminish even more than investment.

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[1] *Proceedings, American Institute of Electrical Engineers,* 1913, pp. 1937–43. In Mr. Lincoln's address as president of the Institute, two years later, he discussed growth in size of plants, among other features of electrical development.

The economies of larger units—boilers, generators, and transformers—Mr. Lincoln represents by straight lines sloping downward on a double logarithmic scale. Translated into a natural scale, and into terms of total cost, these become curves ascending at an ever diminishing slope. With boilers, he estimates that a tenfold increase in capacity yields a 40 per cent economy, so that one could get ten times as large a boiler for six times the cost. With generators, he estimates that a tenfold increase in size brings a 65 per cent economy allowing for equal speeds, so that the larger generator would cost only three and one-half times as much as the smaller. With transformers the saving runs from 65 per cent on 22,000-volt transformers to about 77 per cent on 110,000-volt instruments, so that one could get ten times as large a transformer of the 110,000-volt type for only two and three-tenths times the cost. And since a 10,000-kilowatt turbo-generator requires little more space than one of 1,000 kilowatts, there is another large economy in housing the plant.

Further material savings are secured from superheaters and economizers, which save about 10 per cent of the fuel, and whose relative cost decreases as the size of the plant increases; also condensers, feed water heaters, water-softening plants, mechanical stokers, and other machinery for handling coal and removing ashes, and other devices. He also mentions the screening of fuel, and the securing of a guaranteed and uniform fuel supply by purchasing under specifications—an advantage available only to large buyers. This last is an excellent example of intangible overhead. As for labor, Mr. Lincoln mentions that a 10,000-kilowatt generator requires little more attention than one of 100 kilowatts, the number of bearings being similar. This item of labor is clearly a "constant cost," while all the labor-saving devices already mentioned have their natural effect on the wage-bill. Furthermore, the large plant can have not only larger units but more of them, and thus gain flexibility, being able to run at different rates of output while the working units are always running near the rate which brings maximum economy. There are definite objections to trusting as much as one-fourth of the load to a single machine.[1]

As one might expect from this list of savings, the figures of cost show a decided economy with size, even in the case of quite large plants.[2] With gas, the case is somewhat different, as the economies of size appear to be exhausted before the very large plants are reached. H. G. Barker, in his *Public Utility Rates*, tabulates the operating expenses of seventeen plants of over 500,000,000 cubic feet output, and seventy-six smaller plants, of less than 300,000,000 cubic feet.[3] The smaller plants show cost increasing at a decreasing rate in a well-marked curve. In fact, the curve $y=\sqrt[6]{x^4}$ fits the points quite remarkably well, where y is cost in tens of thousands of dollars and x is output in tens of millions of cubic feet. For the larger plants, the downward curvature disappears and the trend is to all intents and purposes a straight line: $y=.42x+k$, k being so small as to be negligible in comparison with the large totals. In other words, operating expenses of large plants average 42 cents per thousand feet, with no perceptible savings from greater size. These figures behave so like those of railroads that the coincidence is striking. The reader will remember that the curve of operating expense showed a slight downward curvature for roads of small traffic density, agreeing fairly well with the curve: $y = \sqrt[5]{x^4}$; but losing all visible curvature as the traffic densities became larger.

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[1] See *Report of National Electric Lighting Association Committee on Prime Movers*, 1919.

[2] See *Report*, *Wisconsin Railroad Commission* 1916, pp. 640–41, 676–77, for unit costs of companies of class A and class B in that state.

[3] H. G. Barker, *Public Utility Rates*, pp. 297–99. Two of the smaller plants are in large cities and are grouped by Barker with the larger plants.

Telephone companies, on the other hand, show no signs of economy with increased size, but rather the opposite. Figures published by the Wisconsin Railroad Commission indicate that in terms of operating expense, the most economical size is from 350 to 1,500 telephones, while the lowest capital cost falls between 300 and 1,000 telephones, and the combined cost appears to average least for plants of from 300 to 1,250 instruments.[1] The cost for Milwaukee was about double the average for this group, while for Madison it was more than one third in excess. For the smaller plants there is also a much wider range of variation in cost than the larger plants show; perhaps because the personal equation has more scope.

This increase of cost with size does not necessarily measure the cost of consolidating all the telephones in a given community under one organization, since rival companies would have to duplicate a great deal of the cost of the distributing system. However, the decisive element in favor of consolidation is not cost, but service. And in apparent defiance of the facts as to costs, those in the telephone business appear to consider that added business may increase earnings more than it increases expenses, even though it does not cover its pro rata share of overhead. With the data at hand it is impossible to say whether this represents an example of the short-run point of view, where a plant, for the moment, has spare capacity; or whether it is a fair long-run estimate of the cumulative benefits of increased business. As it stands, it represents an interesting and rather typical paradox in economic judgments.

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[1] *Report, Wisconsin Railroad Commission*, 1916, pp. 348–51, 370–73. Combined cost estimated by the present writer on the basis of operating expense plus 7 per cent on cost of plant and equipment.

The introduction of automatic telephone exchanges is an interesting innovation, involving an enormous investment, a corresponding reduction of direct operating expense, and an investment in machines-to-make-machines which looks a generation ahead. This device—a mechanical marvel suggesting a magnified human brain and nervous system—shifts the emphasis from work of operation to work of maintenance, renewal, and extension, which now becomes the chief variable element in costs, and requires foresight and careful scheduling to avoid the vicious irregularities which play so large a part in the business cycle and lay so heavy a burden upon industry.

3. LOAD-FACTORS AND THE ALLOCATION OF COSTS

Public utilities are subject to both daily and seasonal rhythms, though gas plants dispose of the daily peak by storage, and thus do not need producing capacity equal to the highest momentary rate of use. However, the distributing system must provide capacity for the daily peak, not merely for the daily average. These rhythms are to some extent subject to control, but within fairly definite limits. The fundamental habits of people's lives will not be changed by rate systems, but they may learn to cook with gas, or to use electric vacuum cleaners in the home, while factories will use whatever power is cheapest, and will accept restrictions on its use if it is made worth their while to do so. The chief purposes of a rate system should be to earn a reasonable total return, to develop the utmost use of the facilities so long as every service pays at least its differential cost, and to distribute residual costs fairly according to the responsibility of different users for the amount of these costs.

The expenses of a public utility vary with many things. The investment in the central station depends upon the capacity required, and this depends upon the maximum demand the plant expects to have to meet, with the proviso that it pays to build large enough to take care of some years' growth, rather than be continually rebuilding. The investment in the distribution system depends jointly upon the distance which has to be covered and the maximum demand which each part of the system has to be prepared to meet. Here, too, it is economical to build ahead of growth, in moderation. Coal consumed, and some elements of wear and tear, depend upon output; while the costs of billing, meter reading, and investment in meters depend more nearly on the number of consumers than on any other factor, though certain classes would require more expensive meters.

However, the "capacity" expenses do not necessarily vary in exact proportion to capacity, for there is, as we have seen, an economy in plants of large capacity so that cost does not increase pro rata. These costs may depend on maximum demand, but a 5 per cent increase in maximum demand may typically necessitate only a 4 per cent increase in the "capacity costs."[1] Then any given unit of business is self-supporting so long as it pays four-fifths of its pro rata share of the capacity costs. And if the plant has spare capacity, then business need not pay any of the capacity costs in order to be self-sustaining. As for the output expenses—those which vary with output—daily fluctuations will produce one kind of variation in them, seasonal fluctuations another, and long-run growth still another. Output expenses are, of course, reduced to their lowest terms in hydroelectric plants, but are fairly substantial where plants burn coal.

4. SERVICE AND RATES

No rate system can take account simultaneously of all these elements, and any elements which the rate system cannot afford to consider may fairly be ignored. Rate systems must be simple enough for the consumer to understand their general reason for being, while regulating bodies sometimes impose limitations on the companies' freedom in devising rate systems. For instance, it is practicable to differentiate electrical rates according to the user's daily load-curve; therefore, the daily fluctuation of output costs is worth considering. On the other hand, if it were decided that it was impracticable to make seasonal rates to stimulate business at the low seasons of the year, then the seasonal variation of output cost would be irrelevant. In gas plants, it may be difficult to make rational allowance for the daily peak, or to stimulate off-season business effectively, in which case a conservative management might fall back on the fact that a general growth of output, without any change for better or for worse in its daily or seasonal distribution, ought always to pay its full share of the long-run differential costs of increased output. Probably it would be fair, even in electrical concerns, to make every class of general business pay at least this much, though current taken at off-peak hours might claim a lower minimum.

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[1] This 4 per cent need include only expenses made *necessary* to handle a possible increased demand, not labor-saving devices made *profitable* by an increase in output. The latter are really output costs, partly offsetting the decrease in operating expenses per unit of service, which results from increased size.

A rate system is primarily governed by practical considerations. If added use costs the consumer more than it costs the company, there is a probable failure to develop services which would be worth their cost. If added use costs the consumer less than it costs the company, there is a stimulus to wasteful use. And if the concern is in the stage where costs decrease with increasing size, then charges made according to the foregoing principles would not yield the necessary income, and the company must charge more, preferably where it will have the least effect in limiting use. In other words, it should follow the principle of "charging what the traffic will bear" in the best meaning of that much-abused phrase.

The most logical system based on costs would be to charge each customer a lump sum to cover the entire amount of the "consumer costs," or costs which are governed by the number of consumers. This charge would be uniform to all consumers, or to all in a given class. Then each would pay a "readiness-to-serve" charge, covering at least the differential portion of the capacity costs, and divided up according to the consumer's share in the maximum demand which falls on the central plant, so far as that can be determined.[1] This would not be an infallibly just standard, but probably as good as could be devised. To this would be added an output charge covering all the differential costs of output. If the utility is so large that there are no more economies to be had from further growth, then this system of rates will cover all its costs. But if it is in the stage of decreasing costs with increasing size, then there will be some residual or constant costs which must be divided in whatever way seems just or expedient—probably according to "what the traffic will bear."

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[1] The "readiness-to-serve" principle is familiar as a basis for electrical rates. The "Hopkinson rate" is the most used form of rate for large consumers, and is made up of a charge of so much per kilowatt of maximum demand and another

The critical features of this method of rate-making are: the arranging of the rate so that the charge for additional use covers only the output costs, the covering of capacity and consumer costs in a way which does not fall as a burden on additional use, and the fixing of differential costs as a minimum, with liberty to apportion residual costs on principles of justice and expediency. The first principles are definitely recognized in modern electrical rate systems, while the third makes itself felt with quite sufficient force, whether it is recognized as part of the system or not. Manufacturers who could generate their own current are in a position to secure the lowest rate the utility can make, above differential cost, while smaller consumers have no such bargaining advantage.

The form of the rate system varies. Sometimes the consumer and capacity charges are merged. Where the company does not wish to make separate charges for "readiness-to-serve," or is not allowed to do so, the same result is approximated by making a heavy initial charge for current, so that even fairly small users shall pay their capacity costs, and then changing to a lower rate for additional current after the consumer has used sufficient to pay for his capacity costs, whatever they may be.[1] Thus the point at which the lower rate begins needs to be carefully

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charge of so much per kilowatt-hour used. See Watkins, *Electrical Rates*, pp. 50–52 and elsewhere. Watkins notes that rate schedules do not explicitly take account of anything but the amount of the consumer's maximum, ignoring the way in which it fits into the load-curve of the entire system.

[1] This form of rate is known by the name of its inventor, Mr. Arthur Wright, and is the commonest form of load-factor rate, especially for small consumers.

adjusted, so that the system may be something more than a mere discount for quantity used. Where the capacity of the consumer's fixtures is taken as the index of his share in capacity costs, he gets the lower rate after the equivalent of, let us say, thirty hours' continuous use of his total capacity. Thus he can lower his rate without using any more current, by reducing the number or size of his fixtures and consuming the same amount of current as before. But this would not ordinarily result in lightening the company's burdens materially, since the consumer will protect himself by doing without lights in closets, cellars, and other places where they are little used, and the result will be little reduction, either in the peak or in the average load. For this reason other indexes are sometimes used, such as floor-space or number of rooms.

One of the most difficult parts of such a rate system is the choice of an index of the consumer's responsibility for the capacity costs. In some cases the consumer makes a special contract by which he uses current only at off-peak times. Here the consumer's share of capacity costs is nothing at all. At the opposite extreme is "breakdown" or emergency service, where virtually the entire cost is on account of "readiness to serve," and actual output may be next to nothing. A city's demand for water for its fire hydrants is of this sort; it is responsible for a large part of the investment of a water company, though the amount of water actually taken is relatively insignificant. The increased investment is chiefly in the distributing system. The necessary capacity of reservoirs is not greatly increased, though a central pumping station may have to be made larger to be sure of being able to furnish the necessary flow. It would not be absolutely necessary, however, to provide for the largest conceivable demand, since private consumers could be shut off in the event of some great conflagration. Here a rather high grade of judgment is evidently required in estimating the investment which is really called for in order to provide for such demands for intermittent service.

Between these two extremes stands the typical consumer, who uses the service fairly regularly but not with absolute uniformity, and whose demand comes partly on the peak and partly off.

One index of his share of capacity costs is the total capacity of his fixtures. This might be fairly just as betweeen members of a homogeneous class of customers, but would be very unfair as between different classes. However, if a better measure is found for allotting the burden between residences and drug-stores, for example, capacity of fixtures may do fairly well to divide up the class burden among the members of the class. Another test is the consumer's maximum demand. This can be recorded by meters built for the purpose, but it is not considered economically practicable to do this for residence consumers.[1] Furthermore, the demand that counts is the demand at the time of the peak load on the central station.[2] This also can be recorded by a dual meter, or the meter can be arranged to run faster between certain hours, but these methods do not appear to have made their way into permanent use.[3] In the nature of the case, the greater part of the trade is extremely likely to come from customers whose individual peaks come at about the same time as the peak on the central station.

No one index is best for all cases. It depends on the number and size of the customers in a given class, on whether their individual peaks come at the same time as the central station peak or not, and on whether the individual customer is in a position to control his requirements for peak service, if he is given a chance to gain thereby. The mechanical recording of actual maximum demands, or of demands at the time of the central station peak, is an inaccurate basis of rate-making for small customers. For the chief significance to the company of the past performances of their customers is as evidence of the maximum load they need to provide against in the future. It is useless for this purpose unless behavior is consistent enough to make it possible to judge the future by the past. Large consumers or classes of consumers behave consistently, but single small customers are governed too much by chance. A careful study of their individual habits of consumption would make it possible to judge what their proper share in the total peak burden is, but a single day's maximum peak means very little. An average for December and January would mean a great deal more, and might work fairly just results.

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[1] See Watkins, *op. cit.*, p. 137.

[2] *Ibid.*, pp. 50–51. A recent development is the meter which graphically records the entire load-curve, and this probably has a wide field of usefulness for large consumers.

[3] *Ibid.*, p. 56.

In general, however, the exact method of determining peak responsbility is not so important as it is to exempt from capacity charges additional service which comes wholly or mainly off the peak. The practical improvements resulting from scientific rate systems have come not so much from limiting peak demands by penalizing them with heavy charges as from developing off-peak business by freeing it from the burden of overhead. This has been done partly by granting low rates for additional current on such terms that the extra demand must come, in the nature of the case, mostly at off-peak hours. For example, the ordinary residence will not use current for lighting more than a certain number of hours in the day. To increase the average number of hours' use, current must be used for cooking and household machinery. And while some of this service may come on the peak, the net effect will be to increase the ratio between average output and maximum demand. One way of making concessions to stimulate this kind of business is to sell appliances at low prices, taking the profit in the charge for current used. This applies to gas as well as electricity. It has its undesirable side, since it gives the company an incentive to discriminate in favor of appliances which are not too economical of gas or electricity, so that it is probably better, in the long run, not to use one operation to subsidize another, but to let each stand on its own feet, provided a really scientific system of rate-differentiation can be worked out and applied.

However, it is in the development of power for industrial purposes that the greatest gains in off-peak business have been made. The experience of one large eastern industrial center in this respect is striking.[1] In 1907 there was a sharp peak between five and six o'clock in the evening, amounting to more than double the average day-time rate of consumption. Gradually there was built up an all-day demand, until the former peak actually disappeared, its place being taken by a plateau lasting from eight in the morning till six at night, with variations of little more than 20 per cent, the actual summit often coming between nine and ten in the morning. With this change went a steady improvement in the load-factor from 50 per cent in 1907 and 1908 to an average of 71.5 per cent for the years 1917 to 1920, with a maximum of 82 per cent in 1918. In this war year, current was used in large amounts until ten o'clock at night, probably on account of plants working overtime. And it was this evening demand which made possible a total output which was 82 per cent of what it would have been if demand had been uniform throughout the twenty-four hours. This is probably too high a load-factor: too high, that is, for the best results in terms of all the human factors involved. But it illustrates forcibly what can be done by developing all-day uses. During all this time the five-o'clock demand continued growing, and was about five times as great in 1918 as in 1907, so that it appears that these results were not accomplished by compressing the peak but by expanding the business done during the rest of the day.

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[1] See Watkins' *Electrical Rates*, p. 22.

In telephone service the most definite example of rates to develop off-peak business has been in the long-distance service, where night rates have been established. These have had the effect of building up subsidiary peaks, the customers tending to put in calls as soon as possible after the reduced rate goes into effect. In general, the fixing of rates for different classes of service involves difficult questions of justice in apportioning overhead costs. Business traffic is more steady during the day than residential traffic, which tends to concentrate during the after-breakfast and after-dinner hours, but on the other hand business demands a higher speed of service, the benefits of which are necessarily extended to residential users in considerable measure. For these and other reasons, the allocation of costs between different classes is a matter of judgment and hypothesis, in which the results may differ according to which of two hypotheses are used, both being equally plausible.

Telephone companies naturally desire to develop business, and are willing to make low rates to attract users who cannot afford the rates which other users pay. This must, of course, be done under the form of a different class of service, such as a four-party or an eight-party line. Here the range of possible discrimination is limited. A company might be willing to instal cheap classes of service at greater reductions in rates than their relative cost by itself would justify, if they could thereby attract new business and only new business. But many existing customers will shift to the new and cheaper classes if the inducement is substantial, and it is not easy for a regulated public service company to make the quality of the cheaper service intentionally unattractive with the deliberate purpose of preventing the users of more expensive services from shifting to the new class, and so securing the concession which was meant to develop new trade and new trade only.

Thus the principle of "charging what the traffic will bear" cannot be utilized to its fullest extent by telephone companies. Perhaps the clearest economic principle applying to telephone rates is the rule that additional calls, beyond the usual minimum, should cost the subscriber approximately as much as they add to the cost of the company. A flat rate of so much per month for unlimited service tends toward wasteful use, and a uniform charge of so much per call may hinder the profitable extension of business. The uniform charge with a monthly minimum combines the bad features of both, and is only justified on grounds of physical convenience.

5. BUILDING AHEAD OF DEMAND

Where demand is growing, it is only common sense and reasonable economy to build in anticipation of its growth, with the result that some parts of the plant, at least, have more capacity than is needed for present business. Maintenance, insurance, depreciation, and interest on this excess capacity are costs, but costs of what? Are they costs of present business or deferred charges against future business? If deferred charges, how should their amount be measured and what should be the attitude of regulating bodies when the time comes for the company to realize on its foresight? The accounting procedure involved in this question is beyond the scope of the present study, but the principles underlying it can be formulated in general terms.

The sum of costs over a term of years, both operating expenses and capital charges, will be diminished if the company builds sufficiently far in advance of demand, and increased if it builds too far in advance or not far enough. The exact point depends on the rate of future growth, and is therefore uncertain, so that no one can determine in advance the exact best size, and some risk is necessarily involved. This risk may be either assumed by the public or laid upon the company; that is, the company may be held to be entitled to recover a fair return on whatever it has spent, or the public may be held to be entitled to the benefit of reasonably good judgment on the part of the company, so that the company might suffer a loss if it built unwisely. If this latter policy is followed, it is reasonable to give the company a corresponding chance of profit if its judgment proves to have been unusually good.

In any case, it is unfair to make present consumers pay all the idle overhead incurred for the sake of providing for the future business in the cheapest possible way. The cost of present business should be so calculated that with reasonable growth its burdens will be the same as those of future business, and the amount of the deferred charge should be large enough to bring about this uniformity. Both present and future business should pay more than a bare return on the capacity they actually use, and the idle overhead should be evenly distributed between them, so long as it does not exceed a reasonable amount. As to what is a reasonable amount, this should be determined by investigation of the experience of different classes of communities, showing the typical rates of growth, the costs of inadequate provision for the future, or of unduly great provision, and the savings possible from a wise policy. With very large communities, it would probably prove possible to make the plant so flexible that the troublesome element of idle capacity and deferred charges could be reduced to very small proportions, and it might even be disregarded altogether.

The general rule of regulation is that the company is entitled to a fair return on all investment used and useful for the service of the public, but this should not be construed to mean a return only on the capacity which the public requires for the business of the present year only. A certain amount of idle capacity is normally "used and useful," let us say, in 1923, in providing for future traffic in the cheapest way possible; and after that traffic materializes—say in 1926—it is receiving the benefit, not merely of the interest, depreciation, etc., actually accruing in 1926, but of a certain amount of unabsorbed charges accruing during the preceding years. This is an extension of the well-known principle developed by the Wisconsin commission that a "fair return" includes compensation for deficits due to the inevitable period of development which such businesses must go through.

Since it appears not only natural but desirable that a company should carry, a large part of the time, capacity beyond the demands of the business of the moment, it seems to follow that it should be free to minimize the burden of unearned overhead costs by making low rates to develop additional business which may utilize this capacity, with the understanding that this creates no permanent obligation and that these rates may be raised when regular business expands to the point of requiring the full capacity of the plant. Such rates would be difficult to administer, but are justified, at least in theory, by the facts of the case.

6. "FAIR RETURN" AND THE INCENTIVE TO EFFICIENCY

Thus we come to the general question of "fair return" in regulated companies and its relation to efficient management. This question transcends the bounds of a study of overhead costs, and is too large to be treated here. Yet the preceding discussion reveals facts which have an important bearing upon it. We have seen that efficiency is not merely a technical matter;

it includes a knowledge of differential and residual costs, and requires the scientific classification of service and rates so as to promote the best use of the facilities at hand, and a wise policy in the matter of building for future growth. It also includes correct decisions as to when existing plants should be abandoned; when new machines should be installed; when a railroad line should be relocated; when a power-house should be moved to a cheaper location, etc. Even if the requirements of technical efficiency could be determined and standardized by a regulating body, these economic requirements would remain, and would offer still greater difficulties. The regulating body can hardly be expected to set up standards of efficiency in all these matters and enforce them upon the company.

This being the case, progress will be promoted if the company has some chance to secure the rewards of pioneering in the shape of a profit, reasonable in amount and limited in time. There is danger in limiting the company's return too rigidly to its overhead costs as shown in the accounts. This principle shows itself forcibly in determining the point at which existing property should be abandoned and its value written off the books. Whenever new equipment can reduce the total costs of service enough to pay its own overhead, *disregarding any irrecoverable costs represented by the old equipment*, the old equipment has lost its value: depreciation has already occurred. If a commission could always determine when this had happened, it could write this amount off the books, and then the company would have nothing to lose by making the change. But the commissions are not in a position to do this: they must ordinarily wait until the company tries the experiment and reveals the facts. If they then penalize the company, it is penalized not for the depreciation but for recognizing it and making it good an outcome which tends to put a blight on the necessary modernizing of plants.

The differential cost to the company of such modernization should not be swollen by a capital loss for which the modernization itself is not responsible. This is a real dilemma, and points toward the provision of reserves to take care of such contingencies. Where such reserves have not been provided and the contingency arises, it is the part of wisdom to give the company an extension of time in which to write off the value of its obsolete property.

7. CONCLUSION

The questions covered by this chapter are so varied that no simple summary is possible. It is evident that efficiency is a matter not merely of smooth-running machines and economical arrangement of floor-space but of economic analysis of the facts of differential and residual costs, both in their short-time and their long-time aspects, as affected by daily and seasonal fluctuations, by growth in size of plants and by the irrecoverable costs of abandoned property. The requirements of efficiency call not merely for a high grade of intelligence but for a broad-gauge grasp of economic principles and the ability to feel one's way sanely through experimental solutions where no preconceived formula can serve as an absolute guide.

CHAPTER XVII

OVERHEAD COSTS IN OTHER INDUSTRIES

SUMMARY

Introduction, 335—General manufacturing, 337—Merchandising, 339—Agriculture, 343—Coal Mining, 347—Overhead costs in public services, 352—Overhead costs in "consumption," 354—Conclusion, 355.

I. INTRODUCTION

If one asks the question: "How large an element does overhead cost constitute in industry in general?" the answer is not so simple as one might expect, on account of the different varieties and aspects of overhead cost. And if one were to undertake a survey of the field, industry by industry, one would find different aspects emphasized in different industries. It will be worth while, therefore, to make out a rough outline of the subjects which such an inquiry must cover. Such an outline will inevitably contain a deal of cross-classification, since overhead costs may be divided according to the productive factor concerned—capital, labor, materials, or knowledge and organization; according to the type of variation considered—long-run growth, mobilizations of productive energy from industry to industry, and seasonal, cyclical, or other fluctuations of activity; according to the facts of physical production or the character of financial obligations; and according to the person or agency which bears the burden and responsibility—for it may fall on the business enterprise directly concerned, on other business enterprises, on employees, on the public as individuals, on business associations, or on government. In the outline which is here presented, no attempt will be made to follow this four-dimensional scheme with strict consistency, as that would make the framework unnecessarily complex, and the reader will readily recognize which basis of classification is being used in each heading.

1. First and foremost comes the question of the amount of invested capital in an industry: (*a*) total investment, (*b*) perma-

nent equipment, (*c*) specialized and immobile equipment, (*d*) investment covered by funded debt or other forms of fixed financial obligation, such as leases, and (*e*) the surplus capacity, if any, above the amount required to satisfy the demand, including the average demand, the maximum of daily or seasonal fluctuations, and the maximum of the business cycle or the capacity required to sustain the peak of business prosperity. This survey of invested capital throws light on the size of the necessary margin above operating expenses: whether necessary to legal solvency, necessary to the immediate continuance of operations, or necessary to long-run economic soundness. It should be recognized that the mobility of capital is a relative thing and that the loss involved in mobilization, which may be regarded as a form of "sunk cost," grows less as the time allowed for mobilization grows greater. So far as factors can be mobilized, the costs they represent are differential costs of output, but with many of the short-run fluctuations, mobilization is impossible, and these costs must then be treated as constant.

2. Almost equally important is the investment in materials, analyzed with reference to the risk the company runs of being caught with them on its hands in a falling market and being forced to write off part of their original cost as irrecoverable. Another important fact about materials is that while their cost is a direct expense to the business which uses them, it contains or reimburses the overhead costs of those who produced them. To an integrated concern, a large part of the cost of its materials would be overhead. This difficulty can be met by counting only the "value added to materials" and the cost of adding that value, but materials cannot be wholly ignored, since some of the costs of working them up depend upon their amount, character, and value.

3. The economies (*a*) of size, (*b*) of horizontal combination, and (*c*) of vertical combination.

4. Joint costs: that part of the total cost of a series of complementary products which cannot be traced to any one of them.

5. The responsiveness of costs to fluctuations, daily, seasonal, and cyclical. This depends partly upon the facts of invested

capital, but even more upon the character and behavior of the operating expenses, both indirect and direct.

6. Intellectual overhead: the "state of the arts" or the commercial and technical knowledge essential to efficient production, so far as it is limited by economic forces or appropriated as wealth by private interests, or so far as it requires economic efforts to conserve it, propagate it and extend its boundaries. The extent, importance, and costliness of this element in production is no less significant than the manner of administering it. Is it private property or a public good? Is it cared for by individual producers, by voluntary associations, or by local or national governments?

7. If not already covered under the preceding heading, there would be the further question: To what extent does the industry benefit by public services of a special sort? Such services are mostly concerned with industrial and commercial knowledge—the bureau of standards tests materials, the bureau of mines experiments with safety devices and methods, the department of agriculture publishes the results of a wide variety of studies, while agricultural experiment stations and demonstration farms engage in research and education for the good of the farmer, and members of Congress distribute seeds. Aside from this last political anachronism these are all of the nature of scientific development of methods of production, and broadcasting of the results as widely as possible, for the benefit of individual small-scale producers who could not possibly do this for themselves.

8. Last but not least, would come a study of the extent to which labor partook of the nature of an overhead cost; first to the individual employer; second, to the industry at large; third, to the laborer himself, and last, to the community as a whole. This entire matter of labor will require a chapter by itself.

2. GENERAL MANUFACTURING

It is, of course, impossible to generalize about anything so vast and varied as modern manufacturing, ranging as it does from the billion-dollar steel merger to the tiny shop where a girl weaves scarves by hand for those who can pay the price. One important symptom is the ratio of capital to annual output (in terms of "value added to materials"). Mr. Oswald Knauth's analysis of the census figures shows that the average value product of manufacturers was 46 per cent of the capital in 1910, while at one extreme stood a group of twenty-five industries whose value product averaged 103 per cent of the capital and at the other extreme a group of twenty-one industries whose value product averaged only 17.5 per cent of their capital. By comparison, the value-product of railroads was 19.5 per cent of the capital, or 14.4 per cent if "materials, supplies, etc.," are omitted.

Thus the manufacturing plants of heaviest capital investment are about on even terms with railroads. The list includes blast furnaces, lead smelting and refining and manufacturing lead for pipe and sheet, coke, gas, cement, malt, petroleum refining, sugar refining, and moving pictures. In general, the list shows marked similarity to the list of industries in which three-quarters or more of the output is made in large plants, i.e., plants of more than $1,000,000 annual output. Evidently large proportions of capital to labor and large size of plants are related—each is partly cause and partly effect.

As for materials, conditions vary so much that little need be said save that the average outlay is several times the annual outlay for labor, which means that the average concern, besides its own overhead in the shape of return on investment, is paying for a still larger aggregate of overhead costs incurred by those who make the materials it uses. Another way of putting it is to say that a majority of all the overhead costs of industry are incurred in producing things which others use as materials, and must be shifted onto those who use the materials. But to the latter, these are not overhead costs, but direct and variable costs. In being shifted, they have been converted from one form to another.

The elasticity of expenses also varies so much that it is hardly possible to generalize beyond the fact that expenses vary far more in the long run than over short periods, and that in the short run, operating expenses probably vary in typical cases from half to three-fourths as much as output, up to the point of congestion. In special cases they would vary less than this.

These estimates do not take account of one element which is very inelastic over short periods, namely, the cost of materials used. As we have seen, investment in materials is a "sunk cost," in that it cannot be unmade, if demand falls off, and if prices fall, the original cost cannot be easily recovered. One could try, of course, but the only result would be to lose more by not selling goods than by putting prices low enough to sell them.

Thus it is considered wise practice, when prices of materials have fallen, to write the value of one's stock on hand down to the new market level and then undertake to make goods at a profit on this new and deflated cost. The chief economic logic back of this may lie in the fact that the last supplies of goods, which govern the market, are made from materials bought at the new prices, by producers who would not have done it if it had not appeared worth their while. This is the competition which every producer has to meet, no matter when his materials were bought, and he places himself on an even footing with it, so far as accounting can do so, by taking his loss on his materials and not letting it affect his present price policy. Thus a large investment in materials is even worse than a large investment in specialized machinery, when prices swing downward. Observation indicates that at such times businesses with large commitments in materials are the worst sufferers, rather than those whose costs consist largely of charges for fixed capital.[1]

3. MERCHANDIZING

If the manufacturer's outlay for materials covers other producers' overhead costs to an amount larger than his own, still more is this true of the merchant. The studies of the Harvard Bureau of Business Research show the cost of goods sold to have averaged, for recent years, 62.7 per cent of net sales in retail jewelry stores, 68.1 per cent in retail shoe stores, and 88.1 per cent in wholesale grocery establishments.[2] If a commodity retails for one dollar, the retailer may typically keep twenty-eight cents out of which to pay all his expenses, the wholesaler twelve cents, leaving sixty cents as the cost of the goods themselves, of which perhaps twenty-four cents go to manufacturers, sixteen for all forms of transportation, divided about equally between railroads and other agencies, and twenty cents to agriculture, forestry, and mining, while government may contribute one-half cent or more as free overhead, chiefly in interest, depreciation, and maintenance on streets and highways. The strictly constant capital costs—interest, taxes, and insurance—may absorb seven cents in retailing, three cents in wholesaling, three and one-half in manufacturing, nearly four cents in transportation, and about five cents in agriculture, forestry, and mining.

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[1] This point is made in an unpublished manuscript by Professor Alvin H. Hansen, of the University of Minnesota.

[2] See C. E. Frazer, "The Readjustment of Retail and Wholesale Operating Expenses," *Harvard Business Review* (January, 1923), pp. 222–24. The figures for jewelry cover 1919–21; for shoes, 1918–21; for department stores, 1920–21; and for the wholesale grocery trade, 1916–21.

Thus the money the retailer pays for his goods goes to cover other people's overhead costs totaling twice as much as the retailer's, and the money the wholesaler pays for goods covers overhead outlays four times as great as those of the wholesaler himself. Evidently, while it is important for the merchant to protect his own overhead, it is more important for industry as a whole that his part in the system of production should be so ordered as to help protect the overhead of the producers from whom he buys. This means less retrenchment on the part of dealers when demand falls off and prices sag, but this can only be made possible by refraining from overstocking when business is active and prices are high and going higher. The questions this raises are not simple, but it is clear that if a more stable control of buying could be brought about, it would be a great gain to the dealers themselves. But that is another story, and must wait until we come to the question of the business cycle.

How elastic are the expenses of mercantile establishments in response to changes in volume of business? The available figures go to show that expenses vary far less than sales, but this evidence is useless for purposes of quantitative estimates, since the volume of sales measures the ups and downs of prices far more than of physical output. Expenses may be reduced by cutting wages or by reducing the operating and selling force. Cutting wages is a doubtful benefit, for the best employees tend to go over to competitors who have maintained wages, and the concern may lose more, in the long run, than it gains. Reductions in working force cannot easily be made when the concern is struggling to maintain its physical output in the face of a falling market. The policy of maintaining steady employment for the regular force also acts to deter employers from laying off large numbers of operatives. Thus there is considerable resistance to economizing in operating expenses. Mr. C. E. Frazer finds that mercantile expenses tend to rise in times of activity, and fail to subside in times of depression.[1] Further evidence is found in the fact that employment fluctuates far less in merchandising than in mining, transport, or manufacturing.[2] Altogether it is fair to conclude, contrary to the general impression, that expenses are less elastic in merchandising than in manufacturing, and that constant expenses are larger.

So far as "cost of goods sold" is concerned, the question whether this is elastic or not depends on the accounting policy followed. If the concern charges goods at their original cost, this item becomes thoroughly inelastic until existing stocks are disposed of. And if one wishes to know the effect of business changes on the total profits and losses of the concern, this gives a true account. For purposes of guiding sales policy, it may be wise to write the value of goods on hand up or down, following the market; but this merely means that profits and losses due to selling goods are separated from profits and losses due to holding them in stock, and does not affect the sum total. Where concerns have contracted ahead for goods at a fixed price, the result is the same, if the contracts are carried out to the letter; but merchants do not buy their goods in this way to the same extent as manufacturers. If new goods are being bought and disposed of along with the old, expenses become to that extent elastic. But this factor has least effect at precisely the most critical times—those when depression is setting in—since at such times new purchases are at a minimum, and the old goods must be disposed of before new ones can find an unhindered market.

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[1] See his summary of results of studies by the Harvard Bureau of Business research, in the *Harvard Business Review*, as cited in the preceding footnote.

[2] See W. I. King, *Employment, Hours and Earnings in Prosperity and Depression*, especially pp. 49–52. National Bureau of Economic Research, 1923.

This matter of the cost of goods on hand is a more serious disturbing element, in the short run, than the constant costs represented by the permanent investment, since the depreciation of the stock can easily wipe out the entire return to capital, and no retrenchment can affect the loss on goods already bought. On the other hand, when demand does revive, it only requires a small percentage of addition to the price of the product to bring in twofold returns on investment, so that the fat months can make up for the lean. Thus businesses of this class are likely to alternate between high returns on investment and none at all, and their chief problem is to bridge the chasms and achieve reasonable financial stability through the succeeding phases of the business cycle. The evil of chronic cut-throat competition does not affect them seriously.

On the other hand, seasonal changes of demand are not marked by the same unexpected and general changes of prices which accompany the business cycle. True, goods go out of season, and have to be marked down, often without very much regard to their original cost; but this does not usually affect the whole of a merchant's stock at once. Goods may be sacrificed, but it is to make room for other goods which are in season and will sell more rapidly. Thus it is possible to disregard the original cost of such remnants in order to dispose of them, and consider only how to realize the largest salvage, whether by holding the goods until another season, when they will usually be at a discount as last season's goods, or by forcing them on the market at an even greater discount, and thus saving storage, with the costs of moving into storage and out again, and incidental deterioration. In any case the mark-down is limited to the remnants, and does not embrace the whole volume of sales.

Aside from this question of seasonal obsolescence of stock, some seasons are duller than others, and special efforts or concessions may be useful in stimulating off-season demand. But since the idle overhead of the mercantile establishment is relatively small compared to the direct cost of the goods sold, the room for such concessions is more limited than in the case of manufacturers and very much more so than in the case of public utilities. Special selling efforts may utilize the idle overhead of the selling force itself, but heavy slashing of prices is hardly a profitable policy.

The economies of size appear in merchandising, though differences in grade of goods sold often make them hard to trace. In general, the large store spends a smaller percentage of its gross income for the goods it sells, but a larger percentage on operating expenses, especially advertising, while large stores turn their stock over more rapidly, and sell more goods per full-time sales person.[1] Branch houses distributing packing-house products show marked economy with increased size.

To sum up, costs of mercantile establishments are very flexible if moderate time is granted, much more so than manufacturing costs. But they are decidedly inelastic over short periods. The cost of goods sold is a direct cost of output, but the actual amount spent quickly becomes a matter of ancient history: a "sunk cost." If the present differential cost of getting more goods is more than the amount actually spent for the stock on hand, well and good; if less, then sales may show a profit above differential cost, and the concern may still go bankrupt.

4. AGRICULTURE

As has already been suggested, the most definite indivisible unit in farming consists of the farmer himself and his family. Outside help is used to tide over the peak demand of planting time and harvesting time, but it is characteristically hard to get, largely on account of this very irregularity. Land and improvements, buildings, farm implements and machinery and work-animals constitute a fixed investment with an unusually long average life. The total area of potential agricultural land in the world is, in a sense, absolutely fixed; and where it needs clearing, drainage, or other reclamation work it cannot be made quickly available in large amounts. However, there is far more elasticity in the amount actually put under the plow and cultivated to the major crops, and still more where any one crop is considered. The chief resistance to such adjustments is personal, depending upon the knowledge and adaptability of the farmer himself. Men do what they know how to do rather than incur the risks and wastes of trying to find some theoretical "best combination" of crops and methods. Farming is one of the most difficult of trades, and the knowledge unconsciously picked up from childhood on, and habits unconsciously formed, constitute a personal capital whose value is very great and whose inertia is hard to overcome. This inertia has to be broken up and this personal capital converted into something more mobile, through widespread education, not merely in scientific methods but in the methods of picking up and utilizing new scientific methods as they come within reach, before this form of agricultural capital can be made as mobile as the good of the agricultural community requires.

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[1] See Frazer, *op. cit.*, pp. 219–20. Also *Survey of Retail Distribution of Clothing*, V, 15, 187, 277, 395, 406, 420, and elsewhere. Northwestern University School of Commerce, Bureau of Business Research, Horace Secrist, director, 1921.

The single farm has a land area which is often taken for granted as a constant factor, and it is not always convenient to change it. Nevertheless many farm owners rent additional land—14 per cent of one group cited by Nourse.[1] All in all, the total fixed investment in farms is large—far larger in proportion to output than in any major class of industries except railroads and public utilities. It has been estimated that rent of land alone accounts for one-fourth the cost of raising potatoes in Maine, under intensive cultivation, and one-third in Wisconsin, under extensive cultivation.[2] Two groups of farms of varied character show receipts a trifle over 20 per cent of capital. An inspection of some budgets shows about one-fourth of the total expenses to be of a character indicating that they are probably constant to about the same degree as the return on capital invested in railways.

Thus farming is like railroading in that a wide margin above "out-of-pocket expenses" is required to cover return on investment and to provide for betterments, if these are to be made out of income. Accordingly the return can fall far below the economically necessary yield on investment and still cover the actual out-of-pocket expenses, so that the industry may drag along chronically in a half-starved condition without reaching an absolute limit. In other words, it clearly has the characteristics which invite "cut-throat competition," aggravated by the inertia of the human capital involved. This in turn is made worse by the small-scale character of the business, which makes it a burden to keep accurate cost accounts, while special cost analyses must be made by government or some other agency commanding large funds, if they are to be made at all.

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[1] See E. G. Nourse, *Agricultural Economics*, p. 285.

[2] *Ibid.*, pp. 452–53.

A further difficulty arises from the length of the season and the uncertainty of the yield. Few manufacturers would start to make goods for as many months ahead as the farmer does, without a contract at a definite price for a definite quantity which he knew he could turn out. The "sunk cost" involved would be too great. But the farmer has no choice; he must incur it if he is to produce at all. Broadly speaking, there are two points at which he controls his output. One is at planting time when he decides what he will try to produce, subject to the chances of the season, insect enemies, and other uncertainties. His chance of a yield must appear to him worth the sacrifice he incurs for it, but in estimating this differential sacrifice, his mortgage is a constant item, and in most cases the greater part of his investment behaves as a constant cost. The other point where output is under control is at harvesting time, when he is free to let the crop rot if it will not cover the cost of gathering and shipping it. By this time, all his other expenses are sunk costs, and he must simply recover what yield the market permits. Add to this the fact that at planting time, when control of output must be exercised if it is to have any effect, all the growers are committing themselves at about the same time, so that there is little chance for each one to govern his policy by a really accurate knowledge of what the others are doing. If manufacturers were ever so rash as to make "to stock" goods which required a whole season to finish, they would not start them all at the same time of year, and if their rivals' output threatened to glut the market, each one could, if he saw fit, curtail his own schedule of production at any time. All in all, the co-ordination of supply and demand faces peculiar difficulties in agriculture and the producer's legitimate means of protecting his overhead sacrifices operate under enormous handicaps.

Aside from the problems of adjusting supply to demand, there are problems of internal organization. Farm work is very irregular, in ways which have nothing to do with irregularity in demand for the products. Farm machinery, work animals, and hands, all have very poor load factors. The work of horses tends to concentrate in two or three months, and specialized machinery has an even shorter term of use. Gang plows, seeders, and other improvements can make striking savings in the time required for plowing and planting, but they must do at least a fair amount of work to be economically available.[1] Some of these difficulties can be overcome by co-operative ownership of machinery, though the difficulties inherent in this system make large farming units a far simpler solution.

Indeed, so far as physical units are concerned, the farm shows many chances for the economies of size. A large barn costs less per unit of contents than a small one, just as a large boiler does; and farms of large acreage can be adequately equipped with buildings, horses, and machinery at less expense per acre than small farms.[2] Under the system of accounting used in agricultural investigations, the profit-and-loss account is merged with the labor income of the farm owner who works on his own farm. This residual share increases with the total capital invested in the farm, and increases progressively, though with curious irregularities.[3] These may be partly the result of groups of farmers who have too much land and not enough working capital, and "gentleman farmers" who build model barns costing so much that the overhead far exceeds the possible yield of the cattle they will house. Apparently where conditions

[1] See Nourse, *op. cit.*, p. 272.

[2] Nourse, *op. cit.*, p. 285–86.

[3] *United States Department of Agriculture, Bulletin No. 41*, pp. 11–13. Reprinted by Nourse, *op. cit.*, p. 275.

permit the adequate utilization of expensive equipment, large-scale farming pays, though an investment of $10,000 to $15,000 shows the highest labor income *per dollar of invested capital.* The reason why farming is not a large-scale industry is largely to be found in the difficulty of supervising the personnel, though partly also in the character of the ground, which often makes expensive machinery difficult to operate.

From this brief sketch we can see that agriculture presents the typical problems of overhead cost, often in very intense form. In particular, it is an industry peculiarly subject to what is really a form of cut-throat competition. Add to this the difficulties of marketing and the fact that the typical farm has too little working capital for its land area and has not the type of security which easily secures capital on favorable terms, and there is more than adequate reason for a great movement toward agricultural combination and co-operation, such as we are at present witnessing. Add to this the fact that farming, being a small-scale industry, is peculiarly dependent on public or co-operative research to maintain and improve the "state of the art," and to furnish quick and reliable information as to acreage planted and other vital matters, and one cannot fail to conclude that agriculture is a business "affected with a public interest" to a very large extent indeed.

5. COAL MINING

Bituminous coal mining has been much before the public of late in ways which make it a well-nigh intolerable public nuisance. Outside of the recognized public utilities, it is the only great industry in which a seasonal cycle has been universally recognized as a public evil, and proposals made and action taken looking to its cure; and the only industry in which an oversupply of productive capacity has been stated in official reports as a fact injurious to the public and official action has been taken to restrict the evil. "Idle overhead" is one of the largest features of the soft coal problem.

Soft coal mining is a business of some 7,000 operators, few of whom are large, and none of whom dominates the market, except *locally. Bituminous* coal is so widely distributed that there is an indefinite number of possible competitors, able to produce at a profit when prices reach their peak. Most of these are classed as "wagon mines," not having a private railroad spur. The preliminary report of the present Coal Commission states that only 60 per cent of the mines in existence would be sufficient for the needs of the country, and the Interstate Commerce Commission has recently refused the Virginian Railway authority to construct an extension to a mine, stating in its report on the case that there are more mines than is consistent with efficient use of the carriers' equipment and that fewer mines could produce more coal, because the railroads' car supply could be handled to better advantage.[1]

The output of coal is limited, not by mines but by freight cars, because coal is dumped direct from mine car to freight car, saving an extra handling and the cost of storage at the mine. This feature of the industry does not seem to be seriously questioned, since it would do no good to regularize mining without also regularizing the transportation of the coal, and if transportation is to be regularized, coal must be stored, not at the mine, but near the point of consumption. This makes it technically possible to keep both mines and coal cars working with complete regularity, but apparently it is not commercially possible as things are now. Coal mining is seasonal, and would be more so if the peak were not checked by the shortage of cars. As it is, mines sometimes seem to lose almost as much time in the busy season as during the rest of the year.

Mines typically operate from 190 to 230 or 240 days in the year, or an average of perhaps 215 days out of a possible 308. The miner, however, does not work as many days as the mine—in one group of reported cases miners averaged 117 days.[2] The explanation and blame, if any, for this discrepancy is a matter of dispute, but whatever may be the answer, it appears that the load factor of the miner is a more serious question than that of the mine. The answer might even be that no man ought to work more than 117 days underground, but that they ought to piece out their mining with gardening or some other work which would partly support them. If some conclusion on this whole matter could be definitely reached, it would clarify the basis of wage adjustments.

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[1] See *Railway Age*, LXXIV (June 30, 1923), 1691.

[2] Average of 41 Illinois mines in 1929. Reported by Illinois Coal Operators' Association.

In order to regularize mining, the mines must produce some coal to be stored from the spring until the following winter. It only pays to do this with coal whose present value, or cost, is less than its future value by enough to pay the costs of storage; and at present it does not seem to be thought profitable to store enough coal to bring about full regularization. But there is reason to doubt whether this answer can be taken as final. In figuring the minimum price it pays to accept for the sake of keeping the mine running in the off season, the operator presumably charges nothing for return on his investment or other overhead expenses which run on whether the workings are open or not. But he does figure the wages of the labor that takes out the coal as an expense which must be covered. This is so obvious that it seems insane to question it, yet there is strong ground for the thesis that this is not sound cost accounting from the point of view of national efficiency or even from the point of view of the mine operators themselves in the long run; and that wages, in the long run, are nearly as much an overhead cost as interest on investment is, for purposes of figuring the economy resulting from keeping the workings going in slack times and utilizing to the full the productive capacity of the industry.

In the long run it is probably yearly earnings, rather than rates of wages per ton or per day, that have to be maintained at a level high enough to attract labor in competition with other occupations. This assumes that wages are fixed with reference to coal miners who have no side occupations which can be dovetailed with coal mining and so contribute substantially to meet the cost of living. Wage-rates in the anthracite fields are now lower than in bituminous production, partly because anthracite mining is more regular. If yearly earnings from mining are the significant thing, the operators have to pay very nearly as much wages for 215 days' work in a year, or 117 days, as they would have had to pay for 250 days or 300 days, if they habitually operated that many days. But this is not quite the same thing as saying that they could now increase the year's work to 250 or 300 days without materially increasing yearly wages. This might be true, but only in such a very long run that no one could ever tell for certain whether it were true or not. And in the short run, the private operator is quite correct in figuring that if he works ten extra days in the off season his wage bill goes up by exactly ten days' wages. For this reason it is sometimes proposed that labor should be employed on a yearly contract, so that wages would become just as much an overhead cost as capital—and just as much an overhead cost to the employer as labor is to the nation at large. Whether this is practicable or not, it embodies a sound principle.

For the nation as a whole, its labor power is a fixed asset and any failure to utilize it is just as definite a loss as failure to utilize a mechanical plant. It pays, socially, to utilize labor so long as it produces anything toward its own necessary upkeep, which must be met somehow in the long run. Thus social cost-accounting shows a gain from employing labor in a slack season, even if the product will not pay regular day wages to the laborers: social accounting shows a gain where private accounting would show a loss. It is in the light of this sort of accounting, with labor largely an overhead cost, that those interested in the industry should study the costs of storage and other ways and means of regularizing production.

But is there any way of getting private producers to adopt findings that are in conflict with ordinary cost-accounting? The question hinges on whether it is possible to make wages, within limits, virtually an overhead cost to the employer. Anything which would accomplish this result would put the regularizing of coal production on a sound economic basis. We might exhort the wage-earners to work for less pay in the spring and summer months, but this hardly offers an inspiring prospect of success. A more tangible proposal would be a sliding scale of wages, in which the wages per day or per ton are reduced as the number of days' operation is increased, in such fashion as to give the wage-earner some increase in yearly earnings and the employer a decided reduction in the wages cost of coal per ton. It would need to be a decided reduction, because if the plan succeeded there would be more coal to be marketed and the price would presumably have to come down.

It is not easy to draw up specifications for embodying this sliding-scale principle in a wage rate. The most practicable method may possibly be to set a goal of so many days' operation within a certain period, and a basic rate of wages figured on the assumption that this number of days' operation is actually attained. If the goal is not reached, the employer should pay a bonus wage for the time actually worked, the bonus to be figured on the sliding-scale principle, so that the men do not get quite as high total earnings with the bonus as they would without it if the goal of operation had been reached. If the goal is exceeded, possibly the contract could provide a sharp reduction in wages for the remaining days of the period. This might not, however, be practicable. Probably a better way would be to give the employer some latitude in setting the goal, his basic wage rate varying with the number of days' operation that is taken as the objective, according to the sliding-scale already worked out. In this case it would be to the employer's interest to set the goal high, and it might become necessary to set a maximum limit on the output goal and a corresponding minimum limit on the basic rate of wages. The wage-scale should be so fixed as to provide fair minimum earnings if production is not speeded up, while the gain from increasing the number of days' operation should go more to the employer than to the employee, in order to defray the costs involved in regularizing production. The length of the period taken as a unit for calculation would also need to be very carefully considered.

The above is only one suggestion of a means to the desired end. If the matter were given serious thought, other and better plans would doubtless be devised, though none would be "fool-proof," nor free from administrative difficulties and the need of guarding against evasions. But some system of payment working on this principle would give a substantial incentive to regularize this wasteful industry. Seasonal freight rates might contribute to this general result, though by themselves they would be of little effect.

Of course, if the cost of storing bituminous coal is absolutely prohibitive, and conversion into coke impossible, all this is useless talk. But a cost that would be prohibitive to private operators on the ordinary basis of figuring may be far from prohibitive if the problem is attacked in the light of the community method of reckoning overhead costs.

Apart from this, there seems to be much room for increasing the general efficiency of soft-coal mining through the application of known technical principles. Soft-coal mining is a decentralized industry, and the mine foreman is not commonly a technically trained engineer, nor in touch with the best methods in use in other mines. The community's intellectual capital is not being fully utilized: there is "idle overhead" here, real if imponderable.[1] The most revolutionary proposal is to concentrate the burning of coal near the mines in vast central power plants, transmitting it by electricity. This would reduce the manufacturer's overhead, shifting his power cost to an industry of the type which has the most scientific methods of stimulating regular use. The railroads would still have the most irregular part of the coal demand to handle: that for heating purposes.

6. OVERHEAD COSTS IN PUBLIC SERVICES

It is a commonplace that the costs of government departments are not reported on a basis comparable with the standards of good accounting found in private business. In particular not only are interest and depreciation on investment neglected, but the investment itself is commonly ignored and the line between capital and current outlays is frequently blurred.

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[1] See paper and discussion by A. J. Mason and others, *American Economic Review Supplement* (March, 1921). The recent survey by the "Hoover Committee" entitled "Waste in Industry" contains much testimony of waste due to failure to make general use of available knowledge.

This is not the place to undertake a resurvey of public budgets, but a few matters of general principle may be touched upon.

Should interest on permanent investment be charged as a cost of government operations? The practical exigencies of private accounting do not affect the government. It does not declare dividends, nor require to show a commercial balance sheet in order to borrow money from banks. And if it sells goods it is free from the compulsions of competition: it can follow any policy which may appear wise, and can fix any relation it pleases between the price and the total economic sacrifice involved in rendering the service. In a word, its problems are those of cost-accounting and analysis rather than of financial accounting, and as we have already seen, for cost-accounting purposes interest is an important item to consider. On the other hand, where essential public buildings are constructed out of taxes without a thought of money return, interest is not a part of the necessary supply price of the service, and there would be no point in charging it. Nevertheless, a real issue does arise as to the extension of public services, especially into those optional services of an economic character. This involves capital as well as current outlays and fair comparison cannot be made if capital is ignored. The efficient apportionment of capital requires some accounting charge for its use, whether it is raised by bonds or by taxes, or leased from private owners. Where it is a question whether to lease or to build, interest on the cost of building is a decisive item.

How much does public capital really cost the country at large? The traditional economist's view is that the country has just so much income, and that an increase in public capital means just that much taken from private productive investment, or from funds which would otherwise go for consumption. This is true in a very general way, but only in a very general way. It ignores the fact that the national product and national income are elastic and that, under certain conditions and within limits, an expenditure may come at least in part out of an increase in the national product, through stimulating the industrial organism to exert some of its temporarily unused capacities. Thus it is by no means self-evident that every outlay of public funds brings about an equivalent sacrifice of private investment or private consumption. On the contrary, under special conditions a public expenditure may be virtually costless to the community, for example, public works used as means of preventing unemployment. But depreciation is always a cost and should be reckoned with, and the amount of the investment should be known, whether interest is charged on it or not. Furthermore, where the public is rendering a service which might be rendered by a private company, the accounts should be kept and made public on precisely the same basis as those of a railroad or a gas or electric utility.

7. OVERHEAD COSTS IN "CONSUMPTION"

The sharp separation which is drawn in economics between production and consumption tends to obscure some very important facts. For many of the operations of "consumption" are identical in their physical and human character with many of the operations of production. A private residence may change into a boarding-house with only secondary changes in the character of the brainwork and handwork involved in administering it, or in the character of the budget which would be needed to set forth its economic status. Buying is a profession and the selection and use of household materials is an art verging on applied science; between them they are capable of absorbing more time than most full-time industrial occupations, and both are work, not play. True, the industrial revolution has taken the old household industries out of the home, and, of what is left, a great deal is cared for in spare moments which are not thought of as possessing economic value or involving economic cost. They are a sort of human overhead outlay. Modern hotel and apartment living is doing its best to reduce this remainder to the vanishing-point, but it has not yet wholly succeeded.

The fixed investment in a dwelling-house is a constant and more or less specialized outlay. It can shelter a larger family without corresponding increase in cost: and it is hard to adapt to changed conditions in the character of the demand—witness many residence districts full of misfits and anachronisms. The growth of apartments testifies to the economies of size, and central heating plants contain possible savings of combination.

The work of the household—buying, cooking, planning meals, etc., is largely an overhead cost.[1] Here the economy of a large family is very real, though it is so narrowly limited and so bound up with other and more important qualitative values that a serious economic discussion of it might seem to argue lack of a sense of humor. It is of substantial importance, however, in the present-day attempts to produce a scientific measure of the minimum needs of families of different sizes. More complex are the possibilities of combination and co-operation. Indeed, one of our distinctive modern tasks is to bring into being a fund of really scientific information on these matters and to mobilize it for the service of the private household, thus giving the household manager the benefit of what would be a prohibitive overhead outlay if it had to be financed by every family for itself.

8. CONCLUSION

Fragmentary as the foregoing survey is, it should serve to indicate that every branch of economic activity has problems of overhead cost, now in one form and now in another but always of real importance. They are not confined to any one type of industry. We have been taught to look for overhead costs in businesses employing large amounts of fixed capital. These are usually large businesses whose size is sufficient proof that the economies of large-scale production are at work. But farming shows large fixed investments and small-scale operation, and where both these characteristics are lacking, others equally potent appear. If the stock of materials is large, they constitute a sunk cost in times of falling prices. If neither fixed nor circulating capital is large, labor will present some problems of overhead cost. And if the business is organized in small units, that very fact creates a special problem in organizing the intellectual overhead—the "state of the art" and the industrial and commercial knowledge requisite to effective operation.

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[1] Some of these possibilities are briefly suggested in a monograph: "What Can a Man Afford?" by Paul and Dorothy Douglas, *American Economic Review Supplement No. 2*, (December, 1921). esp. p. 64.

Of all these aspects of overhead cost, the least familiar and least appreciated is the human side of overhead costs, their importance in the human economy on which the financial economy rests, and the relation of overhead costs to labor in general. Without some apprehension of the underlying human facts, one cannot see in true perspective such objective financial phenomena as the business cycle or cut-throat competition. Therefore, we shall next turn to the subject of overhead costs and labor.

CHAPTER XVIII

LABOR AS AN OVERHEAD COST

SUMMARY

The human machine: its dual character, 357—The "fatigue of the marginal hour," 359—Ultimate costs of labor analyzed, 361—How much unemployment is necessary, 366—Cost of labor to the employer, 370—The burden of unemployment, 372—Methods of diminishing the burden, 376—Conclusion, 384.

I. THE HUMAN MACHINE: ITS DUAL CHARACTER

The human body is a mechanism and something more. We are gradually enlarging our knowledge of it in its capacity as mechanism, and the results have profoundly altered our ideas of the human costs of industry. A man "feels tired." Muscular exertion becomes unpleasant; the attention flags and wanders. Beyond this stage there may come a "second wind," or even a third or fourth, though there is an ultimate limit at which the muscles protest in positive pain and fail to respond to stimulus. If the will whips the body too unsparingly and for too long a time, there may come a deeper inner fatigue which seems to sap the sources of effort so that one feels enfeebled rather than tired. All these sensations are symptoms of things which are happening to the bodily machine, but the symptoms are none too reliable and none too easy to interpret. Cells are destroyed and must be replaced; poisons accumulate and must be eliminated and there may be positive injury, attrition, or malformation of particular parts of the body, not to mention the recognized occupational diseases and infections.

And all the while this human engine remains a conscious being; it must be reached through conscious stimuli to develop the output of energy for which it was designed, and the seriousness of all this material wear and tear is at bottom almost wholly a matter of what the conscious being thinks and feels about it. One would say "wholly," but for the fact that some of the ultimate values appear to be unconscious; the conscious mind decides on one thing and the man does another. The chief difficulty is that when a person is doing the things which damage his health, he does not know how it is going to feel to go on living and working with impaired vitality. And by the time he does know, it is too late to undo what he has done. The sense of fatigue undoubtedly came into being because it was a valuable safeguard against overstrain, and it seems to work fairly well with respect to the kinds of strain known to primitive man. But the new strains of our machine shops and offices are a different matter, and against them the untaught sensations of the human organism are not such trustworthy guides and protectors.

From the physiological standpoint, the critical point is whether the poisons of fatigue are carried away during periods of rest and the destruction of tissue made good. Beyond this point, fatigue is cumulative and the organism suffers; short of this point fatigue would not be reckoned as a cost at all, but rather a physiological benefit. In a general way, the feelings of the average well-energized person agree with this standard, but he cannot be trusted to know when he crosses the line, especially in our modern sophisticated forms of work and play. This is especially true as a human being has a very large "overload capacity"; he can stand enormous strains for a limited time if he has a chance to recuperate, and he works his best when the pace and strain vary, not on a monotonous dead level of moderate exertion. He also works his best when he gets a reasonable variety; and a job in which the worker can find no variety at all is well-nigh intolerable, as well as likely to overexert some parts of him, leave others underdeveloped, and subject others to unnatural stresses which may produce injuries in the end.

Another fundamental fact is expressed by William James in his *Energies of Men*. A man may be living on a given allowance of food, sleep, and work, and maintaining his weight, strength, and nervous energy in equilibrium. Reduce the amount of food or sleep, or increase the amount of work and unless he had previously been actually overeating or oversleeping, his weight and energy will decline. But they will not decline indefinitely: he will reach a new equilibrium. The human engine can maintain itself in some sort of equilibrium on widely different amounts of rest, nourishment, and output. Especially in the matter of energy, most individuals have large untapped reserves and are capable of being far more thoroughly energized. Even the physiological ratio between attrition and recuperation is probably much affected by one's state of mind, and the limits of monotonous toil, even in a physiological sense, are undoubtedly made narrower because the work is not of a character to do justice to the latent powers of the individual nor tap his reserves of energy. Given the quality of the work, however, physiological limits are fairly definite. The questions we shall deal with have mostly to do with failure to utilize the powers which these ordinary physiological limits make possible and the energies which the common incentives of industry are capable of calling forth.

2. THE "FATIGUE OF THE MARGINAL HOUR"

The usual analysis of the human cost of labor explains that, while work may be a positive pleasure when one is fresh, it becomes more and more fatiguing until the ever increasing fatigue outweighs the ever decreasing worth of more pay, and the man stops working. So far as this analysis goes, the human cost of labor would be wholly a variable cost. This analysis has some truth as a partial explanation of forces governing the length of the working day, but it is hardly relevant at all to the other questions which hinge on the ultimate cost of labor, and it leaves out so much that it appears to be little more than one stone in an unfinished edifice.

From the physiological point of view, fatigue does not begin to be a cost until it involves attrition which the day's rest and food will not make good, and beyond this point the cost suddenly becomes prohibitive in the sense that virtually no reward is worth earning at the price of positive injury to the person himself. Thus instead of being governed by a nice balancing of efforts and rewards, the physiological working-day is governed almost without regard to rewards. Almost, but not quite, for higher rewards mean better food and living conditions and this raises the physiological maximum, and at the same time makes it less compulsory upon the worker to work up to his limit. It is only the lowest rewards that justify working beyond the point where injury to the organism begins. In other words only the utter necessities of present existence are important enough to justify overworking in the struggle to secure them, to the point of sacrificing the fundamental necessity of a healthy constitution.

Aside from utter destitution, it is not so much fatigue which sets the desirable length of a working-day as the need and craving to spend energy in other ways, and to seek relaxation and recreation. It is the urgency of competing calls upon one's energy and time. The most important aspect of the human cost of labor is the aspect of alternative cost. Otherwise it would be hard to explain why the employees of one self-governing establishment were better satisfied with a five-day week of nine hours a day than with five eight-hour days and four hours on Saturday.[1] Another interesting practical consideration is that when the length of the working-day is under discussion between an employer and organized labor, the discussion seldom takes the form of a choice of shorter hours and correspondingly less pay, but rather of a demand for a concession in hours without sacrifice of wages. The free individual choice appears when a workman chooses between different jobs, such as twelve-hour and ten-hour shifts in a steel plant.

But most of the variations in work have nothing to do with a voluntary choice of a longer or shorter work-day. Work stops on account of weather, lack of materials or lack of orders, and men are put on part time, laid off, or discharged. Here is a clear loss of work which is worth far more than it costs the worker, for its cost to him is little or nothing unless he is unusually fortunate in possessing available side occupations. If he has to look for a new job, this in itself costs him more, humanly speaking, than the doing of a reasonable day's work. Thus we arrive at the fundamental proposition that as a general thing, with respect to involuntary idleness, the differential cost of labor is negligible. When labor is laid off, no material human cost is avoided, and if work is found to fill up the gaps, human costs do not increase in proportion to work done. If we are to think of labor as involving human costs, we must think of them as overhead costs, for they certainly do not vary with output in this large and vitally important class of cases.

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[1] W. P. Hapgood, *Survey* (September 1, 1922), p. 656.

3. ULTIMATE COSTS OF LABOR ANALYZED

The cost of labor may be viewed from at least five standpoints: fatigue of labor, maintenance of the laborer, return on investment in labor power, alternatives open to the laborer, and finally the money cost of labor to the employer. Fatigue, as we have already seen, is not such an elastic thing as people ordinarily suppose, especially from the long-run physiological view. Nature says: "Here is a given capacity for enduring fatigue. Use it freely; you will be better and happier if you do; but do not overstep its limits." If these words were used of a machine, we should conclude that the cost of using that machine was largely a constant cost. Labor is sufficiently similar to justify the same conclusion.

The necessary maintenance of labor is even more clearly an overhead cost. Hard physical work calls for more food and the higher grades of mental and directive work require leisure for reading, travel, and other forms of productive consumption. But underneath is a constant element: the minimum standard of living.

What is the nature of this minimum? It takes two forms, both of which have their counterparts in industrial accounting. One is the maintenance of the existing fund of vital power, and the other is a goal or standard of satisfactory maintenance. One corresponds to the accounting conception of maintenance and provision for depreciation; the other corresponds to the standards of performance which attempt to increase efficiency—standards which are always mechanically attainable but often very difficult to attain in view of the human equation and commercial conditions. The laborer cannot live forever, any more than the machine, but he must replace himself without evident deterioration of the stock. In fact, occidental civilization is so accustomed to something which it calls "progress," that unless there were at least some change which could be so construed by anxious observers and willing "boosters," most occidentals would feel that life was an intolerable failure, and the results would be serious. This has its accounting analogue in betterments charged to operating expenses, or in reserves for contingencies.

Thus the bare maintenance of the *status quo* merges into an arbitrary standard of satisfactory performance, and the dividing line is a hazy one. The objective of the "social minimum" is to prevent any considerable class from sinking or remaining below a given minimum. But it is coming to be recognized that the minimum is an elastic thing, and students of this question tend to distinguish three levels: the minimum of physical existence, the minimum of decency, and the minimum of comfort; and they have come to recognize that the social income is not sufficient to provide the higher minima for the poorest groups of workers, and also meet all the other unavoidable demands upon the funds.

Another standard which might be set as an ideal goal is a level such that it costs the community less to maintain it than to fall below it. There are costs of institutional relief to be borne if maintenance is not met, and much larger losses in productive efficiency. Without attempting to define just where this line comes, we can be quite sure that the laborer does not avoid the cost of maintenance by sleeping on a park bench and living on fifteen cents a day; he deteriorates and both he and the community bear the cost of the deterioration. Thus there is a very large element of maintenance cost, or its equivalent, which goes on whether the laborer is employed or not, and which falls on the laborer if he has reserves to meet it, and on both laborer and community if his reserves are inadequate.

Another element in labor calculations is the return on the investment which labor represents. Training is an investment, and the maintenance of the minimum standard is a paying investment for the community as a whole, but these have one distinctive peculiarity, since no matter who makes the investment, the result is the private property of the laborer himself.

Others may benefit, but they cannot own the thing from which the benefit arises, because they cannot own a human being. Some modicum of training every firm must give its workers, but beyond this minimum lies a wide zone of potentially profitable human investment. If the worker himself can afford the cost, well and good. But if he cannot afford it someone else can, and the community as a whole cannot afford to allow it to be neglected. If capitalists invest funds in training others, the yield may be a high one, but there is no way by which the capitalist can appropriate it. He must in most cases advance the money without tangible security, and such loans are not regarded as business transactions. Hence these investments are peculiarly a matter of community concern.

In the matter of training, parts of it are of general value, and parts are specialized and not transferable from one occupation to another. Specialized training is like specialized capital—wasted if the possessor shifts his occupation, and partly wasted if he works short of his capacity. On the other hand the human engine is equipped with faculties for learning new things, and these faculties do not disappear as soon as the worker has learned one of the limited sets of mechanical processes which constitute the modern automatic factory's substitute for a "trade." If this exploring faculty remains idle, there is a waste as serious as many other wastes we have been studying, and for the sake of avoiding it, it is worth while to sacrifice some of the value of things one has learned. The waste of shifting from job to job is real, but must be estimated in the light of the opportunities for variety and growth which a single job affords.

Some workers shift too much; others too little. Sometimes a skilled workman could get less skilled work in times of depression and does not, partly because he feels the cruder work to be beneath him, partly because it would spoil the fineness of his hand and partly because it would cast doubt on his status as a genuine skilled worker in the minds of future employers, thus tending to "spoil his market." So far as the business cycle is concerned, if the skilled man took the unskilled job he would be taking it from some other man who needed it more, so that the gain to the community would be more than doubtful. At such times the "lump of labor" is genuinely limited, and a single laborer can do little or nothing to increase it. Needless to say, this would not be true where trades with different seasonal periods are systematically dovetailed together, whether on the initiative of laborer or employer. The advantages of this are so obvious that no ordinary craft lines should stand in the way.

At length we turn to the cost of labor in the sense of alternatives sacrificed. As we have seen, if a given hour's work really has a traceable human cost, it is almost always on account of the character of the work, compared to some other use which might be made of the same time and energy. The cost of giving up leisure is the most truly variable element in labor cost. This cost has the interesting property of increasing as the rewards of labor increase, since it takes money to make leisure worth having. The giving up of leisure does not begin to involve any cost until the wage has provided for the necessities of physical existence and a reasonable stock of energy. Up to that point the worker is in a deficit economy, with fatigue and human undermaintenance as the dominant quantities. After the surplus point is reached the positive value of leisure increases with the funds one has to furnish the means of enjoyment, subject to the general law of diminishing utility. Thus the giving up of leisure is a variable cost of labor.

But what about irregular and involuntary unemployment? Does this furnish leisure which compensates for the loss in wages? Would a stop-gap job cause the giving up of leisure approximately balancing the worth of the wages? Clearly not. Unemployment is not a vacation, and while it may be made use of by way of education, this does not take the place of a steady job, and the two are not so incompatible that the job must be given up if adult education is to be had. No, when an unemployed worker finds a job, the leisure he gives up has no very material value, and costs him no very material sacrifice.

Aside from the question of job or no job there is the question of which job. A man cannot adopt one thing as his main occupation without giving up some other possible product, so long as there are two products he might make; which means so long as there are more things needing to be done than the normal working time of the normal working quota of the population will suffice to accomplish. One need not ask whether this work is worth the sacrifice of doing it, because if part of the normal working force is not being utilized, that question settles itself. Anything worth doing at all is worth the cost of utilizing "idle overhead" of any sort, material or human.

Thus there is a sharp distinction between two kinds of case. One concerns the mobilization necessary to put industrial resources in their proper places and in the proper proportions—seeing to it that there is enough and not too much devoted to cutting lumber, baking bread, making automobiles, and searching out new forms in which to put our increase of productive power. The other has to do with utilizing idle capacity of labor and capital whose main occupation is unquestionably sound, so that there is no need of permanent remobilization. In the first case, the long-run alternative cost of devoting labor and capital to one occupation is substantially their full market worth, while in the second case the alternative cost of filling idle time is next to nothing, unless the supply of auxiliary occupations is equal to the demand. And this will not come to pass until all seasonal irregularities are dovetailed into each other and the remainder reduced to the proportions of satisfactory vacations and reasonable fluctuations of working speed, and until the still more unmanageable business cycle is reduced to similar proportions.

To sum up the drift of this argument, there are few elements of the ultimate cost of labor which vary even roughly in proportion to amount of work done, and those which do so vary are chiefly alternative costs or "opportunity costs." And even these are not variable to any great extent when it is a question of utilizing idle energy, or rather idle portions of the normal quota of time and energy which can fairly be devoted to industrial employments. This proposition cannot be reduced to an ironclad formula, and must be applied with wise discrimination between case and case. Nevertheless if we had to choose between two sweeping propositions: one saying that the human cost of labor varies in proportion to work done and the other that it is a "constant cost," the latter would be preferable because it expresses those truths of which the present industrial system is most oblivious and around which the constructive effort of the present generation needs to center.

4. HOW MUCH UNEMPLOYMENT IS NECESSARY?

In this connection one fact needs to be faced which is too often slighted, both by business men and economic theorists, namely, the fact that mobilization itself implies and requires some unemployment. It calls for an "industrial reserve army," both of capital and of labor, though not to the extent nor for the reasons which the Marxian theory supposes. To the extent that this is really inevitable and essential to industry, it is not a waste, though the question still remains how to reduce the loss of power to the smallest possible proportions. Therefore we must raise the question how much unemployment is really necessary for industry; not because there is any immediate danger of having too little unemployment, but because this question will help toward setting a reasonable goal and toward determining who benefits by unemployment and who should bear the burden of the irreducible remainder.

The need for unemployment focuses around nine points, as follows: (1) The need of industries to select suitable applicants from among the candidates who present themselves, and to reject the unsuitable. (2) The need of workers to explore the market in order to find the place in which they can be most useful and most happy. (3) The need of being able to launch new enterprises without actually pulling away too many men who are already working in established industries. (4) The need —if it really exists—of the fear of losing the job as an incentive to make labor put forth as much effort as industry has a right to demand. (5) The need—if it exists—of strikes, to protect labor's legitimate interests, or of a replacement force in case of strikes, sufficient to prevent the community from being at the mercy of organized labor, but not sufficient to put labor at the mercy of the cut-throat competition of unemployed workers who must take anything they can get. Aside from a very few strikes, these needs are probably not real; certainly the community needs no unemployed army of potential strike-breakers to protect it from organized labor, though it might be worth something to have a supply of employed workers, qualified for the essential jobs in every trade, but employed in other trades. (6) The need of having this reserve of unused trade knowledge implies that workers must have moved about from trade to trade in the process of acquiring it, and this involves some necessary unemployment, though possibly no more than is already implied in laborers finding the places to which they are best fitted. (7) The need of a supply of labor to handle seasonal peaks and other incidental irregularities in particular industries. This implies mobilization, and mobilization implies some unemployment, while there is a further residuum due to the fact that the various seasonal peaks cannot be perfectly dovetailed together. Here one must distinguish carefully between the need of some unemployment and the need of throwing upon labor the burden of financing it. The two are separate questions. (8) The need of a reserve to handle the peak of the business cycle. Here again, what industry feels as a need is to have this reserve without paying for its upkeep during the idle times. To have the reserve and pay for it would hardly be felt as a boon. (9) The need of throwing upon labor a part, at least, of the burden of dovetailing together seasonal occupations and finding work in dull times, (*a*) to stimulate laborers to do their best in this direction and to make some concessions in order to utilize their own idle overhead, and (*b*) to relieve industry of a financial burden which it could not easily bear, and of the necessity of regularizing employment to a greater extent than it now finds practicable.

A little consideration of these nine points will show a marked difference between the unemployment which persists even at the peak of industry and that due to a shortage of work. In the former kind, laborers and employers share both the burdens and the benefits, and the chief difficulty arises in the case of the naturally handicapped. Industries compete for the best workers, and their competition is made keener by the subdivision of labor and the use of expensive machinery, since a poor worker can slow up a machine which costs far more than his wages, or spoil materials into which has gone the work of a dozen men more expensive than himself. The presence of large overhead costs widens the gap between the productive worth of fast and slow workers, and has a tendency to shut out the latter from highly mechanical types of work.

This is natural and perhaps inevitable. These slower or less efficient laborers should find those places where their qualities put them at the least disadvantage, and they cannot expect to earn as much as those who are more rapid and efficient. The chief evil arises from the fact that, for the workers who fail to find a regular place in mechanical industry, the available places are too many of them of the casual sort, so that the burden of casual labor is largely concentrated on one class. And casual work tends to make casual workers. Thus from him who hath not, modern industry takes away even that which he hath.

The casual worker may be characterized as one who bears the burden of his own maintenance during idleness, for the benefit of the spasmodic peak demands of industry, whereby industry gets the use of his peak capacity without having to pay for the idle overhead, while the employee's task of piecing out his maintenance is too difficult to be successfully performed. The casual worker himself cannot do anything effective to diminish the amount of casual work, but industry can. Therefore, on pragmatic principles of responsibility, industry should bear a large part of this burden. The cost of the weeding-out process whereby industries select the fittest workers is made unduly great by leaving the undesirables at the mercy of whatever work their disadvantages enable industry to impose upon them rather than directing them into a kind of job which will conserve and develop whatever limited store of productive power they may possess.

Do laborers require the fear of losing the job in order to make them work hard enough? Many do, it must be admitted; and discharge for inefficiency, as a last resort, is a necessary part of any system of labor administration worth prescribing for human beings as they are. But discharge on account of dull times is a different story and its net effect is thoroughly harmful to efficiency. Men work harder in order to hold their jobs, at just the time when their efforts can add nothing to the national dividend, since the industry cannot market added goods if they are turned out. And then when jobs are plenty they attempt to prolong that happy state by working as little as they dare, at just the time when industry could market additional goods if they could only get them to market, and when output does actually depend on how hard the workers work. Thus the fear of unemployment, so far as it is due to lack of work, has the effect of reducing efficiency and output, not increasing it.

This question leads on to that of unemployment during depressions, but before leaving the subject of the unemployment which persists even in busy times, it must be noted that there is a very real problem of diminishing the cost of the legitimate recruiting and mobilization service to which such unemployment is incidental. Better organization of labor markets and labor exchanges may make it more easily possible to work at one job while looking for another, to set the field of employment before the worker in clearer and more comprehensive fashion and generally to diminish waste motion. This is a true public service; an example of intangible overhead in the shape of market knowledge, which only a central agency can organize to the best advantage.

As for unemployment resulting from industrial irregularities; the necessity of idleness is one thing, and depends on the extent to which industry can be regularized. The necessity of letting that idleness take the form of "unemployment" as we know it—meaning that the worker bears the burden of his own idle time—is a very different thing, and amounts to assuming that industry cannot be made to bear full responsibility for all the overhead costs of which it receives the benefit. The result is that those who can do the most to regularize industry do not have the incentive, because they do not bear the worst of the costs of which irregularity is the cause. Unemployment in this sense is mostly, if not entirely, unnecessary, though it will take a long time and much painful experimenting to eliminate it.

In discussing railroad discriminations in an earlier chapter, it was argued that the roundabout road whose capacity is needed at the peak has an equitable claim to a share of traffic and earnings off the peak, even if that means routing some shipments by a route which is not the cheapest. On the same grounds the worker whose capacity is needed at the peak has at least as strong a claim to a share of work and income at other times, even if better men sometimes work short of full capacity in order to give him a share of their job.

To sum up: the really necessary unemployment does not constitute a serious problem, though its cost should be minimized as a matter of economizing idle social overhead. The unemployment due to business fluctuations is, in its present form, unnecessary, and fair social accounting would place a major part of the burden on industry, rather than all of it on those classes of labor least able to bear it successfully.

5. COST OF LABOR TO THE EMPLOYER

Part of the cost of labor is already obviously an overhead cost to the employer: namely, the budget of the salaried force, and the essential wage-earners who share that security of tenure which is the most fundamental mark of the salaried status.[1] Members of this class expect to adapt their hours to the requirements of the business: to work overtime without extra pay, to receive a vacation with pay, to be kept on the rolls during sickness (within limits), and during dull times. Thus the salary budget is virtually constant, and there is a visible movement toward extending this status to labor in general. Some go so far as to guarantee full yearly earnings, others one-half or one-third pay during a lay-off. The Columbia Conserve Co., for instance, has for some years placed practically all its permanent workers on a yearly salaried basis, and has used many expedients in its endeavor—largely successful—to dovetail work together so as to avoid unemployment.[1] Their achievement is notable, because canning is such an extremely seasonal business, but they have not eliminated the need for reliance on casual labor.

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[1] Cf. G. P. Watkins, in *American Economics Review*, V, 770–77 (December, 1915).

As for common labor which does not get the benefit of such an arrangement, the more irregular jobs either get enough higher pay than the regular ones, to compensate for their irregularity, or they do not. Generally they do not, and in this case the laborer and his family and friends, or the community, are paying part of the overhead cost of the industry. If there are cases in which the wage fully compensates for the lost time, then the industry is paying all the overhead and might have had a full year's work for the same average pay if they had only been clever enough to stabilize employment. Even now, if work were stabilized, considerable reductions could be made in the cost of labor per full day's work performed, but the gain would have to be shared with the laborers. A single employer, taking the lead, might have a harder time in realizing the lowered labor cost to which he was entitled than the entire industry would if they acted in concert. He would find it difficult to break away from the general wage conditions as set by his competitors, but might be able to do so if he could back up his offer of steady employment with a definite guaranty, as numbers of employers are now doing.

In the usual case, wages in irregular jobs are high, but not high enough to equalize average yearly earnings; and the employer has some incentive to regularize, but not nearly enough. Along with this go more general incentives. The desire to keep the organization together and the realization of the cost of letting it go to pieces, the recognition of the burden of casual labor and the fact that those who make free use of such labor bring that burden upon themselves, and the slow realization that unemployment acts as a boomerang—"a cause and not a result of business depression," as one writer emphatically puts it—all these tend toward the conclusion that when labor is laid off its cost does not disappear; it changes its form, and a very appreciable part of it comes back to plague the same industry which started the vicious circle by laying off its workers. One industrial manager testifies that our "orgies of hiring, firing, and hiring again are, we notice, infinitely more expensive than more or less stabilized production."[1] This burden, of course, is diffused. Each employer feels the effects of what all the others do, and only a part of the effects of what he does himself, whether for good or ill. Thus the overhead cost of labor is a collective burden upon industry in general, but the market does not allocate to each employer the share for which his own enterprise is responsible.

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[1] See W. P. Hapgood, "The High Adventure of a Cannery," *Survey* (September 1, 1923); also Paul Douglas, "A Case of Genuine Industrial Self-Government," *University Journal of Business* (November, 1922, and February, 1923).

6. THE BURDEN OF UNEMPLOYMENT

Unemployment is difficult to measure, owing to the difficulty of defining full employment, but the average amount of time lost has been estimated at from 13 per cent to 14 per cent of full time.[2] Of this amount strikes are responsible for a variable proportion, less than 1 per cent, while sickness accounts for about 2 per cent—more for women and less for men.[3] This leaves something like 11 per cent to cover cases in which the worker does not want the job or the job does not want the worker, but chiefly the latter. Professor King's figures indicate that the number of whole days lost because work was not available averaged about 10 per cent of full time for male workers during 1920–22, ranging from 4 per cent to 15 per cent, approximately, between the busiest and the dullest three-month periods. The minimum loss from this cause may be estimated at about 4 per cent of full time. This represents chiefly seasonal unemployment and chronically casual work, which even busy seasons do not cure of all lost time. The total effect of depressions is best expressed by King's estimate that the crisis of 1921 reduced the volume of employment in the United States by one-sixth.[1]

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[1] Ernest G. Draper, in pamphlet entitled "Unemployment," reprinted from the *New York Times* of September 11, 1921.

[2] See Percy and Albert Wallis, *Wages, Prices and Profits*. Also estimates by Massachusetts Department of Labor and United States Commissioner of Labor, and some figures given in W. I. King's "Employment, Hours and Earnings in Prosperity and Depression," *National Bureau of Economic Research* (1923), esp. p. 73. Professor King does not, however, attempt a definite estimate of the absolute volume of unemployment, confining his study instead to changes in the volume of employment—a more tangible quantity.

[3] See W. I. King, *op. cit.*, pp. 72–73.

This grand total, large as it is, gives no idea of the real problem of idle time for labor. In the first place, it does not show the very heavy seasonal unemployment. Agriculture, for instance, shows almost no reduction due to depression; its lost time is wholly a seasonal matter and falls naturally on the class of hired employees, so that they bear more than their share of the total seasonal fluctuation of work. The number working in the first quarter of the year is only 58 per cent of what it is in the third quarter. This figure varies considerably from section to section, the South showing the least fluctuation and the Rocky Mountain section the most, while day laborers fluctuate more than laborers hired by the month. In the mountain region there are more than eight times as many day laborers in the third quarter of the year as in the first.[2] King's estimate that the seasonal rise and fall amounts to 900,000 seems quite conservative.

The fitting of these 900,000 into other seasonal occupations would constitute an enormous task of mobilization even if other occupations expanded their requirements in just those months when the need on the farms is dwindling. But unfortunately there does not appear to be any such general seasonal compensation. When the farm did much of its own manufacturing, such work was naturally done when the pressure of farm work was lightest. This meant a low load factor for the simple equipment used, but that was negligible compared to the time of the workers themselves. Industrialized manufacturers are not so considerate; they work according to demand instead of according to the time when the pressure of other kinds of work is light and hands are idle. The farmer himself does not time his purchases as he would time the making of those same goods if he had to make them on his farm. He suits his convenience, not the seasonal curve of employment.

Thus industry as a whole simply does not make room for these 900,000, unless it changes its schedule so as to do so. It is a mockery to invite them to dovetail their harvest jobs with others; they cannot make the jobs, and they are simply being lured into the man-trap of casual labor. This is, of course, not true of all individuals, but the statistics show it as an inexorable fact for hundreds of thousands. Construction work and transportation, especially railroad maintenance of way, have a seasonal curve similar to farming, and tend to aggravate the incorrigible discrepancy between supply and demand.

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[1] *Ibid.*, p. 53.

[2] *Ibid.*, pp. 37-38.

Aside from seasonal unemployment, the grand totals for years of prosperity and depression do not show how the burden is concentrated in certain industries and certain classes of establishments. While the general ratio between boom and depression is 6:5, mining, steam railways, and factories as a whole all show cyclical declines of close to 30 per cent from 1920 to 1921–22, the manufacture of metals and metal products showing over 50 per cent.[1] Still more remarkable is the fact that there is vastly more unemployment in large establishments than in small, industry by industry, and that the typical falling-off in employment in large industry was well over 30 per cent, with large-scale agriculture not far behind and mercantile enterprises showing relatively great steadiness.[2] Out of 4,100,000 workers removed

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[1] W. I. King, p. 55.

[2] *Ibid.*, pp. 55–58. The following figures show the maximum percentage of cyclical decline in hours worked, 1920–22, for different industries in enterprises of different sizes.

INDUSTRY	NUMBER OF WORKERS PER ENTERPRISE		
	Less than 21	21 to 100	Over 100
Agriculture	4.28	17.35	25.93
Extraction of minerals	0.	41.31	30.18
Building and construction	14.66	15.11	46.93
Finance	0.	0.	25.58
Steam railways	....	....	38.18
Other transportation	3.72	9.80	8.17
Wholesale trade	0.	12.31	7.77
Retail trade	1.31	4.66	10.84
Factories	8.21	19.21	38.56
All industries	3.08	13.84	28.23

The figures for the decline in number of employees on the pay-rolls are about four fifths as great, indicating that about one fifth of the burden takes the form of part-time work.

from the pay-rolls on account of depression, 3,300,000 came from concerns employing over 100 workers in the first quarter of 1920, some 500,000 from those employing between twenty-one and 100, and something over 200,000 from those employing less than twenty-one workers.[1] When one remembers that the most skilled and experienced employees are kept on through a depression one wonders how the least valuable quarter of the workers in large industries get along at all. And there must always be a least efficient quarter!

How shall the cost of this irregularity be measured? One possible measure is the productive worth of the time lost, if that could in turn be measured. Not all of this idle time could be redeemed, but the major part of that caused by the business cycle is potentially redeemable. If the nation were a business firm it would set a goal or standard toward which to work. Any such goal which might be set would call for a saving of at least 5 per cent of the nation's working power, averaging good years with bad, even if the objective were merely half-time for everyone formerly unemployed on account of lack of work. Another measure would be the maintenance expenses which labor must try as best it may to meet during idleness. Here it is worth while recognizing both the whole amount of idle overhead which labor has to try to meet, due to all causes, and also the avoidable part of it.

Estimating average unemployment from all causes at 4,000,000 and average cost of maintenance of the unemployed and their dependents at $1,200 per year, we would have a total "idle overhead" of $4,800,000,000 which labor or someone else must finance, if it is financed at all. Taking the maximum decrease in number of workers employed due to both seasonal and cyclical causes at 5,000,000, and estimating the cost of maintenance at the same rate, the burden would be $500,000,000 per month at the worst period of a depression. Under favorable conditions labor can and does successfully finance a large part of this burden, and there is no reason for attempting to take it all from their shoulders. But the total amount, unevenly distributed as it is, is altogether too heavy to be successfully borne by those groups on whom the incidence is heaviest.

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[1] *Ibid.*, pp. 30–33.

The manner of bearing it varies. Chronic casuals with only themselves to look after may get along for considerable periods on as little as 50 cents per day, and weather a hundred days of winter on considerably less than $100, but not without serious harm to their working powers, physical and mental. Men with families to feed and rent to pay require much more. Aside from their savings, they are often carried on credit by the grocer, or helped out by friends and neighbors in other ways. Behind these stands organized charity, whose budget shows a vivid picture of the ups and downs of employment. For instance, the Associated Charities of Cleveland in five pre-war years cared for twice as many families in midwinter as in midsummer, and from the fall of 1920 to the end of the winter of 1921–22 the number increased fourfold.[1] It seems a conservative estimate that more than half the burden of organized relief is really a cost of seasonal and cyclical fluctuations in industry, and that if this amount were thrown upon industry directly, it would still be only a small fraction of the loss for which these fluctuations are economically accountable.

7. METHODS OF DIMINISHING THE BURDEN

Remedies for this evil are many, some private and some public; some looking toward diminishing unemployment and some merely toward compensating the victims or insuring them. The most hopeful symptoms, and those most in harmony with the trend of the present study, are those which indicate that the employers' sense of responsibility toward their problem is undergoing a process of crystallization into more and more definite forms. It is only within recent years that this appears to have been regarded as a task peculiarly incumbent upon the managers of industry as such, by virtue of their position, their resources and their opportunities, and not merely a matter of personal charity. More recent is the growing sense that this is a cost of industry, occasioned by industrial irregularity, and that it must be borne by industry in the last analysis. Still more recent is the dawning consciousness that particular industries have some responsibility for the idle overhead of the workers they employ at the peak, and that a considerable part at least of this burden can be successfully borne by industries in the regular course of their industrial operations. If this belief grows stronger, it is not unthinkable that this vague community overhead should be allocated to industries and divided among the partners concerned, in really workable fashion.

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[1] *Survey* (September 15, 1923), p. 716.

At present, the laborer's chief weapon for actually diminishing unemployment is to submit to a cut in wages sufficient to make it economically worth while for employers to hire him. The employers would, of course, be expected to accept a corresponding paring-down of profits and the resulting reduction of prices might do a great deal to stimulate off-peak business. The basic idea of this proposition is logical and sound. Labor has everything to gain by making it possible for the employer to use the time that is now idle without paying the full prosperity wage for it, provided this can be done without establishing the special low rate as a new standard wage applicable to all work. This would be "spoiling the market" for labor with a vengeance, and would be likely to mean that the ground painfully gained through costly strikes would be given up, so that when business revived the whole struggle would have to be fought over again. Thus it is easy to see why labor should attempt to defend its rates and protect its overhead even at the expense of unemployment.

In order to avoid this dilemma, it would be necessary to establish a clear-cut separation between normal wages, which must be adequate to cover labor's maintenance, and special reductions made to stimulate off-peak business and avoid unemployment and not required to cover their full share of labor's overhead costs. Both would need to be recognized parts of the same scheme of wage rates, so that wages could return to normal when conditions justified it without the necessity of a new bargain and the struggles and probable strikes attendant upon it. This dual system of wages would be enormously difficult to establish, especially in the case of casual labor, which is partly unemployed at all times. The casual laborer simply could not charge a wage rate high enough to compensate for his irregular work and at the same time decrease his percentage of idle time by selling his services for "what the traffic will bear" to employers who might furnish additional work. The laborer is not like a great company, able to discriminate and to make up its overhead costs on part of its business while granting concessions on the rest.

The privilege of obtaining work for less than a living wage is a dangerous one to experiment with, unless the shortage between wages and cost of living is already underwritten, or somehow provided for. Not only are employees unwilling to accept such wages; employers are reluctant to grant them, and with good reason, under existing conditions. For regular wages are not high enough to permit labor to accumulate adequate reserves to finance the family through periods of starvation wages, and if wages were adequate to this purpose, still there would always be a large group who had not made adequate provision, for one reason or another. Thus they would still have to finance themselves out of current earnings, and the employer cannot afford to pay wages on which it is clearly and admittedly impossible for labor to live. Such a policy would amount to cut-throat competition on the part of labor, in spite of the most strenuous efforts to prevent.

Furthermore, organized labor is engaged in a continuous campaign to increase the share of the product which goes as wages, and looks at the immediate situation from the standpoint of its effect on this paramount undertaking. Thus they strive to raise wages in prosperous times, when demand will permit it, and to keep them from falling in dull times, so that the next rise may start as nearly as possible where the last one left off. Thus the settled policy of organized labor is chiefly governed by the determination to protect labor's overhead by keeping wages up, rather than to utilize idle overhead by adjusting them to the ups and downs of demand. Thus all wages are loaded with their share of labor's idle overhead, and additional labor in dull times costs the employer more than it costs the laborer, with the result that work which would be worth doing remains undone.

It goes without saying that such a generalization as this cannot be an accurate description of anything so many-sided as the labor market and labor policy. Many exceptions need to be made. Especially where there is something like a relation of genuine partnership between employers and employees, labor often voluntarily accepts a cut in wages in order to enable the industry to keep running. Such concessions are, however, limited by the general rule that wages, even under such conditions, must cover the necessary living of the laborer, and the differential cost of labor to the employer remains higher than its cost to the laborer.

In spite of all the difficulties in the way of removing this obstacle to full employment, it is possible to adjust the wage relation so as to cure the worst of the evil, where the employee has a regular position, such as would be furnished by a yearly contract. Here it is possible to arrange such terms that, within limits, the differential cost of added labor to the employer is low, while the laborer is not dependent on this low differential rate to cover all his living expenses. Where laborers are on a salary basis, this of course settles the problem so far as they are concerned. But as it would be impossible for industry to carry all of its workers on this basis, the workers who are in most need of such provision would not be directly affected, and could only benefit indirectly where the system resulted in a general stabilizing of work in the entire industry.

Another plan is to guarantee a minimum of employment for a given period. In 1912, Swift & Co. introduced a minimum weekly wage equal to forty hours' pay for all employees on the pay-roll at the beginning of the week, and other packers have followed this example. This of course would not prevent a seasonal lay-off, but it seems to have had some good results, aside from the obvious benefit to the men of knowing what wages they could count on. The employers are said to have become more careful of the quality of laborers they hire, and they have taken steps to secure the co-operation of railroads and shippers of live animals toward regularizing the receipts at the packing-houses, distributing them over the week instead of concentrating them heavily in two or three days.[1] A number of employers have guaranteed yearly earnings, some at full rates and some at one-half or one-third rates during lay-offs.[2]

The Cleveland Ladies' Garment industry in 1919 set its face toward regularization in a joint agreement of employers and employees, and the outcome was a plan which went into operation in June, 1921, whereby if a company fails to furnish twenty weeks' work in any half-year, it pays wages for the shortage at two-thirds the minimum union rate, out of a fund created by setting aside 7½ per cent of the direct labor pay-roll each week. If the fund is exhausted the employer's obligation ceases. This means that the employee can be out of work for six weeks before the company's guaranty becomes effective.[3] Thus the employee has an incentive to look for a job, and the employer can save as much as 7½ per cent on his direct labor bill by furnishing fairly regular work, as compared to a competitor who only furnishes, let us say, thirty-five weeks' work in a year, and thus uses up his unemployment fund. Here the employee bears, on the face of the agreement, a larger part of labor overhead than the employer, being liable to the extent of six weeks out of twenty-six or 23 per cent of full time, while the employer risks only 7½ per cent on the time he actually works. It will require much experimenting to divide the burden so as to avoid laying a crushing weight on either party, while giving as effective a stimulus as possible to reduce irregularities.

The Dennison Manufacturing Co., a pioneer in the regularization of highly seasonal labor, carries a fund raised by joint contributions, and Mr. Henry S. Dennison, the president of the company, states: "Upon a fairly large class of goods we found it would be cheaper to manufacture to stock and store for long periods than to pay unemployment relief for idleness."[4] This puts the policy of making to stock on a business basis to the extent of making it the lesser of two financial evils, but does not furnish funds to carry it on. As we have seen (chap. ix), of two possible policies the lesser evil may still never yield a positive profit, but merely avoid a larger loss. Such policies cannot be financed without reserve funds. Thus the next step is to use the unemployment fund, under proper regulations, to help finance production which will save the fund from being depleted, and Mr. Dennison mentions this as a proposal containing a suggestion, at least, of a policy of insurance against the depression phase of the business cycle.[1]

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[1] John Calder, *Survey* (October 15, 1922), p. 95.

[2] *National Industrial Conference Board Bulletin 43.*

[3] *Survey* (January 14, 1922), pp. 594–95.

[4] See *American Labor Legislation Review* (March, 1921), pp. 41–47 and 53–59; *ibid.* (March, 1922), p. 34.

Ordinary insurance against unemployment would mean that each employer and each industry insured its workers, and the insurance fund or company paid the benefits. This would have the great defect of leaving the obligation too general, unless there is provision whereby the individual employer's premiums vary directly with the disbursements which his own enterprise occasions. On the whole it would be more normal if each enterprise had its own fund and insured itself against the possible exhaustion of that fund.

Another method of making the employer pay something for labor's idle overhead is the simple requirement of a month's pay on dismissal, or other similar bonus. This system is already customary in some occupations. It is a very rough-and-ready measure, and the payment may be unnecessarily large in some cases and not large enough in others. It might have some usefulness in giving the employer an incentive to divide up a shortage of time among his laborers rather than to let some go entirely, and this is a beneficial thing, so long as it is a matter of a seasonal or a chronic oversupply of labor. Such a measure should be judged in connection with other possible measures for allocating labor's overhead, and not as a thing by itself.

If the employer becomes in adequate measure responsible for the idle time of the workers his industry requires, this removes the chief objection to the policy whereby each industry has its own private reserve of labor, more or less isolated from the general market. An employer is entitled to keep a claim on his workers' time through periods of idleness, provided he pays a fair price for the privilege, covering its cost to the worker. But while the *responsibility for compensation* may be individualized, *the work of finding jobs for the inevitable remainder of jobless* can still best be done if the various contingents of unemployed are merged into one mobilizable army. Seattle longshoremen have recently been definitely organized in gangs under a joint organization of employers and employees, and classified into "company gangs," which represent the labor for which each company undertakes to assure reasonably steady work, and "hall gangs," constituting a single reserve for the whole industry, mobilized from a central dispatching hall. This organization has also enormously reduced the supply of labor so that the remainder can share their idle time and still earn vastly more than previous average wages. This was done largely by keeping out "floaters" who left the docks and then wished to come back, and also by eliminating the least competent. The total number registered was reduced from 1,420 in September, 1920, to 612 in August, 1921, but as 1921 was a year of heavy business depression some allowance should be made in interpreting these figures.[1]

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[1] *American Labor Legislation Review* (March, 1922), p. 34.

This case illustrates one corollary of assuming responsibility for idleness as part of the unabsorbed overhead of the industry: namely, a great reduction in willingness to employ distinctively casual labor. And since labor becomes casual chiefly because people employ it on casual work, the natural result must be a diminution in the number of casual workers and their segregation into a fairly well-marked class. Both these conditions are favorable to successful handling of the peculiar difficulties of distributing and financing the costs of this type of labor.

This very brief discussion has aimed not so much to treat of methods of reducing unemployment as of the general economic status of such methods and the economic incentives available to promote them. Broadly speaking, any measures for the cure of unemployment cost something, and are a recognition of the fact that the cost of idleness—the unabsorbed social overhead of labor—is greater than the cost of finding work. The community will probably always continue to bear a considerable part of this cost, but there is an increasing tendency to regard it as an industrial expense. Mr. Dennison, who has earned the right to be regarded as an authority, puts it in these words:

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[1] For data on this Seattle experiment see the *Survey* (October 15, 1922), pp. 96–97. Statement prepared by the joint Executive Committee of the longshoremen and employers.

> It is better social cost-keeping to add the overhead burden of unemployment to those goods which are responsible for irregular employment than to draw it from the savings of the working group The whole burden put upon wage-earners and reacting upon their knowledge of their helplessness to affect its causes, arouses resistances and irritations which make smooth running of the social organization impossible. Industry has a considerable share in the opportunities for mitigation of unemployment, hence industry must be spurred to their exercise by carrying part of the burden.[1]

Mr. Calder lays down three propositions: each industry needs a surplus of labor; the surplus, for the social good, should be kept as small as possible; and it should be carried at the expense of the industry.[2] One might add that where it is genuinely possible for the casual demands of different industries to be dovetailed together to any important extent, these industries would have an adequate reason for merging their liability.

Evidently industrialism is in process of evolving a new principle of economic responsibility.[3] In the next chapter there will be something more to say about measures for diminishing unemployment, when we take up the greatest single source of waste productive capacity and unnecessary idle overhead: namely, the business cycle. To see this great problem in a true perspective, it is absolutely essential to keep constantly in mind the facts with regard to the ultimate sacrifices of labor which the preceding discussion has very imperfectly set forth.

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[1] Henry S. Dennison, president of the Dennison Manufacturing Co., in *American Labor Legislation Review* (March, 1922), p. 32.

[2] John Calder, *Survey* (October 15, 1922), p. 96.

[3] Aside from the examples already mentioned, the Walworth Manufacturing Co. has done pioneer work in the regularization of labor, while no discussion would be complete without recognition of the work of B. Seebohm Rowntree, as employer and writer (see especially *The Human Factor in Business*, *Industrial Unrest*, etc.).

8. CONCLUSION

In conclusion, this chapter has discussed many ways in which the costs of labor may be viewed, from fatigue to the financial outlays of industry, and has found a decisive element of overhead cost in all of them. If there is a chance to employ labor to good advantage in some other occupations, then to keep it where it is involves a genuine sacrifice. But we have seen that in times of general shortage of work there is no such resource available to the great mass of unemployed. The human cost of any decent job is less than that of walking the streets looking for work, to any worker not already demoralized by unemployment. In this sense, labor has no differential cost; so that whatever ultimate cost there is must be regarded as an overhead burden.

Of course, labor does feel fatigue, enjoy leisure, seek variety, and find an elastic rhythm of activity more salutary than an even monotony. Not all the costs of labor are constant, and the laborer cannot stand the kind of load factor which would represent absolute efficiency in the case of a machine. But the idleness bred by modern industry goes so far beyond any reasonable need for variety that it is a clear evil. If we ever gain effective control of it, it may then be time to ask how far we should go in eliminating it, and where we should stop. But at present that is an academic issue.

In short, there can be little question as to whether labor is or is not an overhead cost for all purposes concerned with unemployment. The only question is as to the best distribution of the burden—the best form of social cost-accounting. And on this point a change is visibly making headway in industry—a change which may end by revolutionizing our customary ways of looking at expenses and financial responsibilities. The distribution of labor's overhead costs can no longer be left to the stipulations of the customary wage contract; it must be remodeled in the light of essential justice, and of the principle of placing burdens and incentives where they can do the most good in bringing about the action which community efficiency demands.

All of which may be little more than a complicated way of saying that waste is waste; that anything worth doing is worth that much more than nothing and that any means by which our wasted productive powers can be salvaged is economically justifiable. But we have formed the habit of subjecting such questions to the further question: Does it pay? Does economic value cover economic cost? And in order to have economic standing, a discussion of these wastes must necessarily be cast in this mold. Having once set out to weigh values and costs, there is nothing for it but to probe through the fallacies, shiftings, and distortions of the conventional financial calculus, and to carry the analysis far enough to show that, in the end, it does not give the lie to common sense.

CHAPTER XIX

OVERHEAD COSTS AND THE BUSINESS CYCLE

SUMMARY

Introduction, 386—The concentration of capital expenditures, 389—Other causes at work, 396—The shifting and conversion of overhead costs, 397—Steadying prices versus steadying production, 403—Remedies for the business cycle, 407—Reactions and consequences, 413—Conclusion, 415—..

I. INTRODUCTION

It is needless to point out that overhead costs play a fundamental part in the behavior of business at every stage of that many-sided phenomenon, the business cycle. The part they play is most paradoxical. For they make regular operation peculiarly desirable and peculiarly profitable, so that business feels a definite loss whenever output falls below normal capacity, and yet it is largely due to this very fact of large fixed capital that business breeds these calamities for itself, out of the laws of its own being. And the largest businesses, which have the highest percentage of constant costs due to invested capital, are, as we have seen, precisely the ones which fluctuate the most, so far as employment is an index. There is something about the commercial-industrial system which bewitches business so that it does just the thing it is trying to avoid, and is held back from doing just the thing it yearns to do—maintain steady operation and avoid idle overhead. And while the contributing causes of this strange auto-hypnosis are many and of varied character, technical, financial, commercial, and psychological; the underlying fact of large capital plays a central part, and the inelasticity of costs, sunk costs, and the shifting and conversion of overhead costs are all facts of major importance.

It is out of the question, in the limited space available, to present a rounded discussion, and such a discussion would be aside from the main purpose of our present study.[1] It will be sufficient here to consider chiefly those factors which have to do, directly or indirectly, with overhead costs. In the first place, there is the fact that costs and profits depend upon output and hence upon demand, quite as much as upon productive efficiency. One result of this is that the producer has a wider option in price policies than he would have if volume of sales had no effect on cost of production per unit. If demand increases he can make increased profits without raising prices, if he sees fit, or he can raise them with a view to making up the uncovered overhead resulting from previous periods of depression. Next there is the concentration of capital expenditures and the accompanying intensified fluctuation in the demand for capital goods and in the output of the industries producing them. This operates in connection with the fact that an increased demand for one commodity (if not neutralized by decreased demands for others) results in a further general increase in demand, though giving the producers of that one commodity more purchasing power.

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[1] If the reader wishes to make a thorough study of this subject, he cannot adopt a better guide than W. C. Mitchell's *Business Cycles*. This book not only

Another fact is the shifting and conversion of overhead costs, which arises when goods are passed on from industry to industry, so that the financial accounts of the separate industries distort the true proportions of constant and variable costs in industry as a whole. Further elements of rigidity in costs are connected with standing contracts for goods, and with the lagging response of wages and interest rates to the upward movement of prices and business earnings. Another fact is that the demand for goods consists partly of demand for future use, and is affected not so much by the absolute level of prices as by the direction in which prices are expected to move. And finally, when costs of production rise, the critical thing is not the rise taken by itself, but the position in which it catches producers in undertakings to which they are committed. All these elements play their part, along with the business form of mob psychology, the capacity of the credit system for expansion and shrinkage, the distribution

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marks an epoch in the study of the business cycle but is a landmark in the progress of inductive methods of economic study. See also studies by O. M. W. Sprague, B. M. Anderson, W. W. Stewart, jr., H. L. Reed, and *Business Cycles and Unemployment*, National Bureau of Economic Research, W. C. Mitchell, director.

of purchasing power, and other things jointly responsible for the disease of intermittent paralysis from which industry suffers.

Viewed broadly, this disease appears to be a joint resultant of special disturbing forces, mostly external to industry, and of the internal laws of the business mechanism itself. By external causes are meant such things as wars, the influence of weather on the crops, an earthquake, or a change of any sort in consumers' desires. Inventions and the growth of new industries are not external to the economic system, but they are not part of its routine operations. They are special events, each one unique of its kind. Some writers have emphasized the external forces,[1] but most theories have attempted to explain how industry brings these evils on itself. The detailed study of the history of cycles makes it plain that all have similar features, indicating the operation of the regular laws of the business organism; and yet no two are exactly alike, indicating that outside disturbances or other special causes play an appreciable part.

Whenever business starts moving in one direction, the movement shows a strong and definite tendency to reinforce itself in cumulative fashion and to keep on at an accelerating pace until its momentum carries it beyond the point of equilibrium, if such a thing exists, and reaches its limit only after having gone so far that a reaction is inevitable. The distinguishing characteristic of economic forces of the supply-and-demand variety, as usually analyzed in economic theory, is that they are self-limiting; the more they prevail the weaker they become, and the stronger grows the resistance. The business cycle shows unmistakably that the forces at work there are not self-limiting in the typical fashion but self-reinforcing throughout a great part of the swing of the pendulum. Ultimately, limiting forces make their appearance, but not until long after the mid-point of the swing is passed. The whole motion is suggestive, not so much of a pendulum as of that kind of oscillating electric fan which trips a reversing plane near the end of each oscillation and then swings back until it trips the plane again. The thing which most needs explaining in the business cycle is why the forces of supply and demand work in this cumulative fashion. Mob psychology explains much of it, but it also has a more rational basis in objective economic facts, especially those concerned with investments of fixed capital.

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[1] The outstanding example is the Jevons sun-spot theory, and the more recent theory of climatic cycles developed by H. L. Moore.

2. THE CONCENTRATION OF CAPITAL EXPENDITURES

Expenditures and additions to capital equipment are proverbially postponable. This means that under farsighted and public-spirited management, they can be distributed so as to give the builders of plants and the makers of machines reasonably steady employment; or that under ordinary management expenditures may be so concentrated as to give the makers of machines a very bad load factor indeed. As things are, this type of demand is extremely irregular, so much so as to constitute one of the major disturbing elements in our entire economic order.

The observed facts which bear upon this question are, in general, as follows: The demand for means of production fluctuates more violently than that for finished consumers' goods, and also appears to fluctuate sooner, taking the lead in a way which would suggest that its changes are a cause, rather than an effect, of the changes in consumers' demand. In point of fact they are both effect and cause, as we shall see in a moment. Something similar is true of raw materials as compared to finished goods, while wholesale prices fluctuate more than retail.[1] These facts all point in the same direction, and can be accounted for on a consistent hypothesis.

For the intensified fluctuations in producers' goods there appear to be two main reasons, aside from the force of psychological suggestion. One is financial; the other wholly independent of the money economy. In the first place, postponable expenses tend to be timed according to what seems the most profitable policy. This means that they are hastened on a rising market in order to buy before the price goes up still farther, and retarded on a falling market in order to wait and buy at still lower prices. Thus rising prices stimulate demand, and falling prices check it, at least for the time being. Hence a rise tends to cause a further rise, and vice versa; and if enough people expect prices to move in one way, that may of itself bring the movement to pass.

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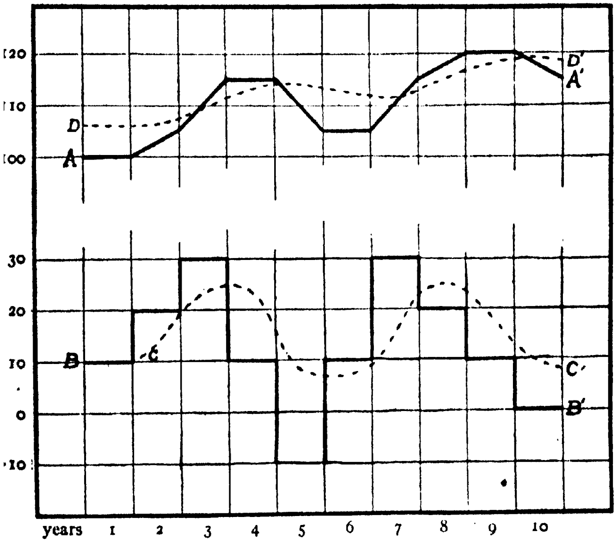
[1] These phenomena are described and analyzed at length in Mitchell's *Business Cycles*, already referred to. The central importance of construction work as a cause of cycles is the basis of Hull's theory. See Geo. H. Hull, *Industrial Depressions*. New York, 1911.

But aside from all questions of buying at the cheapest time, the physical need for new equipment shows a tendency to fluctuate more intensely than the demand for the finished product, because it depends, not upon the total volume of demand, but upon the rate of growth (or shrinkage): the amount added, for example, during the current year. In other words, the velocity of output in the capital-making industries depends, not on the velocity of output in the industries which use the capital to make goods for consumption, but on its acceleration. Since this is bound to be a minus quantity nearly half the time, even if the demand for finished products never completely stops growing, it is easy to see that the makers of capital equipment are bound, in the nature of the case, to suffer an absolute decline in the demand for their products, not only semi-occasionally, but chronically, whenever ultimate demand slackens its rate of growth. And if the demand for finished products stops growing, the need for additional equipment naturally falls to zero, while a relatively slight decline in the demand for consumption means that the need for additional equipment becomes actually a minus quantity. It would then be economical to unmake some of the equipment and something like this actually happens in extreme cases, for equipment is allowed to wear out without being fully replaced.

Once demand for finished products starts growing it cannot pause or else the derived demand for means of production will shrink, and when it shrinks, the resulting unemployment will produce a shrinkage in the primary demand. Apparently the interrelations of business are such that a growing demand cannot slacken its growth without bringing on itself an absolute diminution. It must keep on growing in order to stay in the same place!

This feature of our economic organization is one with which the Red Queen might feel at home, but ordinary human business managers are like Alice in the Looking-Glass country, and find it hard to learn to turn their backs upon their obvious objective in order to reach it; that is, to buy equipment when they have no immediate need of it and when funds with which to buy it are scarce. Instead, they commonly keep aiming toward the garden of prosperity, only to find themselves walking in at the door of depression and unemployment. Such are the pranks which the Iron Slave plays upon his supposed masters!

CHART VII



AA' = Demand for ultimate product.
BB' = Derived demand for equipment.
CC' = Work of making equipment.
DD' = Equipment in service, in terms of normal capacity.
Vertical dimension shows quantities demanded or produced, $000 omitted.

The principle at work is illustrated in Chart VII, which represents a hypothetical manufacturing industry in which equipment is equal to twice the amount of the value annually produced by the manufacturing process—a typical proportion. If this equipment lasts twenty years, the annual replacements will equal 10 per cent of the annual value product, and this figure is supposed, for simplicity, to remain steady, since its fluctuations would not be sufficient to change the dominant movements. Changes in prices are also ignored, for purposes of this preliminary diagram.

In the first year the primary demand (the upper solid line) is shown stationary. In the second year it rises 5 per cent. In order to furnish 5 per cent additional equipment, however, the output of equipment would have to be doubled, and two dollars' worth of extra equipment would have to be made for every dollar's worth of extra finished product turned out. If the whole economic system were an impersonal machine, with no psychological or financial complications entering in; and if it took no time to make the equipment, this is exactly what would happen. In the third year, primary demand grows 10 per cent[1] more and the derived demand is now three times its original amount. In the fourth year, primary demand stops growing, with the result that the derived demand (the lower solid line) not merely stops growing, but falls back to its original amount, or one-third of the maximum which it had just reached. In the fifth year, primary demand falls 10 per cent, and derived demand now falls to less than nothing; and so on.

In order to make this example more realistic, two major facts must be allowed for: first, the time required to make equipment and, second, the limited capacity of the equipment-making industries. As a result of these forces, the productive activity in the equipment-making industry will follow a course like that of the lower dotted line, and the amount of equipment in use will behave approximately in the way shown by the upper dotted line.

In terms of percentages, the theoretical need for equipment fluctuates twenty times as much as the widest range of fluctuation in the consumer's ultimate demand, and even in terms of dollars it fluctuates twice as much.[1] The actual work of making equipment fluctuates by from six to seven times as large a percentage as consumers' demand, and its downward swings, if not its upward ones, are absolutely greater in terms of dollars and cents. This clearly exhibits the intensification of fluctuations in derived demand. But the timing of the curves with relation to each other is even more significant. The theoretical need for construction of equipment is greatest, not when the demand for the ultimate product is greatest, but when it is growing fastest, considerably before it reaches its peak. As a result, the work of making equipment may lag considerably behind the need (as it naturally would do) and still it will naturally reach its highest point and start downward before the consumers' demand does so. It will appear to lead, not because it really does lead, but because the thing it follows reaches its maximum and minimum points something like a full quarter-cycle ahead of the highest and lowest points of consumers' demand. This hypothetical case, then, offers a rational and seemingly adequate explanation of the fact that the capital-making industries appear to take the lead in industrial fluctuations.

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[1] Figured on the original amount as a base.

One further point is also vital. An increase of one dollar in the demand for consumers' goods produces, in time, an increase of two dollars in the output of equipment, so long as the makers of equipment are able to expand their production. It is safe to suppose that most of this two dollars is spent for consumable goods, and of this the manufacturers receive their share. If all industry is moving in the same direction, they also receive a share of the increases due to purchases of equipment by railroads, mines, etc. On the whole, it seems fair to assume that one dollar's worth added to the output of consumable goods brings back another dollar to add to it, and that the two may bring back two more, and so on, as long as the capital-making industries still have capacity for expansion. When things have reached this limit, further growth of consumers' demand is impossible, and this removes the need for additional equipment so that demand for equipment falls off, the producers of equipment have less money to spend and thus consumers' demand falls off in turn. When the shrinkage in capital-production can go no farther, consumers' demand also ceases to fall, which soon brings the demand for equipment up to its original level, and this in turn increases consumers' demand, and a new cycle is ready to begin. This is a rough and impressionistic way of expressing it, but it seems to be essentially true.

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[1] The need for equipment ranges from 300 per cent of its original amount to −100 per cent, a total range of 400 per cent, while the primary demand ranges from 100 per cent to 120 per cent or 20 per cent actual change. This method of figuring errs on the conservative side, as it understates the real discrepancy between the two fluctuations.

So much for pure hypothesis. In an actual case, the financial magnitudes would fluctuate more than the physical, since prices would rise with reviving business, and vice versa. Notwithstanding this compounding of forces, the physical facts remain. The writer has elsewhere studied the relation of railroad traffic to orders for cars, showing that orders for cars fluctuate far more than traffic, and that they are at their highest, not when traffic is largest, but when it is growing fastest.[1] For the present purpose it will be more worth while to examine the result of the orders for cars, in the form of cars added to the railroads' equipment. The figures would naturally not agree exactly, on account of retirements, and the actual delivery of the cars would naturally lag behind the orders.

The result is shown in Chart VIII. The net increase (or decrease) in cars follows the net increase (or decrease) in traffic, lagging by about a year and with decidedly less violent fluctuations. Nevertheless, it fluctuates several times as violently as railroad traffic itself, even after allowing for replacements and assuming them constant. As for the timing of the two curves, the yearly interval is too long to give a sensitive record of correlation, but the net increase of equipment has the appearance of taking the lead of traffic about as often as of following. The years 1917–19 are, of course, not normal. When one remembers that the work of making the cars comes between receiving the

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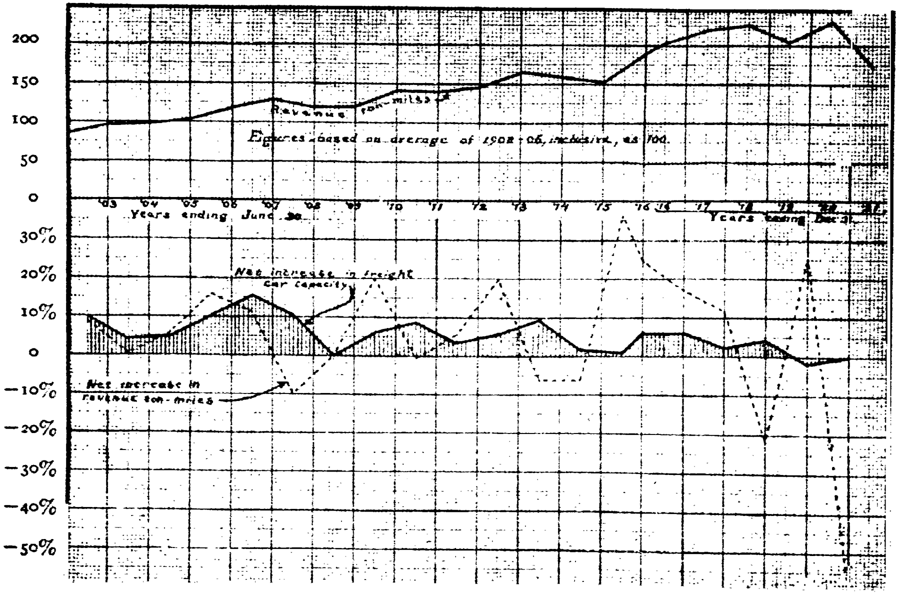
[1] See "Business Accelerations and the Law of Demand," *Journal of Political Economy* (March, 1917), pp. 217–35.

CHART VIII



Growth of freight traffic and of car capacity. Data from Chart I, chapter xiii, above orders and delivering the finished product, and therefore that its highest ranges would be spread between the points of greatest increase in traffic (which makes roads order cars) and the points of greatest increase in cars actually in service, it seems clear that the work of making cars fluctuates appreciably ahead of fluctuations in railroad traffic. On the whole, the figures appear to corroborate the theory, as far as they go.

3. OTHER CAUSES

Of course, all this presupposes an elastic credit system, so that industries can buy equipment without taking just that much money away from the people who would otherwise have spent it on consumption. The funds can be borrowed from banks, and the banks can furnish them without immediately taking them out of consumers' purchasing power. If this were not possible, the spending of money on equipment would have no chance to return in the shape of a cumulative increase in consumers' demand, and the self-reinforcing cycle would have no chance to get under way. An elastic credit system is the great enabling cause of all these movements.

The undue concentration of capital expenditures ought to be relieved by the effect of high prices at the peak and low prices during a depression, which would make it worth while to buy equipment during depressions for the boom that is coming, and deter people from buying at the peak. But while fluctuating prices ought to work in this way, they do not. If anything, they seem to work in the other direction. People might like to buy at the bottom, but they do not know that they have reached bottom until they have not only reached it but passed it and are unmistakably starting up the other side. Then they begin to buy, and rising prices will rather spur them on than deter them, so long as they expect prices to go still higher, for they can more than get their money back from consumers—or so they reckon. And no one knows when the top is reached until it is past and the downward swing has begun.

It is of the very essence of the business cycle that, while any intelligent business man knows enough to expect it, no one can know absolutely at what stage of the cycle he is on that particular day, nor in how many days the next stage will appear. That they do not know this is another reason why they so manage their several businesses as to bring on themselves the very thing they do not want—this, and the fact that they have learned to look for its coming with a fatalistic resignation. Some even derive considerable consolation from the chance to discipline labor in the harsh school of unemployment.

And so we might go on, discussing the lagging rise of wages and interest, the effect of fixed contracts in a changing market, the overcapitalization of expected future earnings, the decrease of unit costs as output increases, followed by a somewhat unexpected increase as capacity is reached, and costs are swollen by overtime, green men are hired, laborers take things easy because they are sure of their jobs, and prices of materials and equipment rise faster than those of the finished product.

This last phenomenon clearly has a close connection with overhead costs. When demand is strong and increasing, competition between producers takes the shape, not of reducing the price of the finished product, but of offering more for the factors of production. This takes effect first and strongest on the prices of materials and equipment, while wages do not rise as much as prices, and interest rates are decidedly slow in rising. And because operating expenses do not increase as fast as output, it is possible to pay a higher premium for materials and equipment than is being received for the finished product, and still make a gain in profits. That is, it is possible so long as the point of increasing cost has not been reached. After this point is passed, the gain is turned into a loss, but many producers have committed themselves, by contract or by the installing of equipment, and find it difficult or impossible to draw back. One of the sources of danger in this whole situation is the producers' lack of accurate knowledge as to where the economies of increased output come to an end. Better analysis of the real behavior of constant and variable expenses might save considerable losses.

4. THE SHIFTING AND CONVERSION OF OVERHEAD COSTS

We have already seen how the underlying costs of production continually change their form as they are passed on from producer to producer, generally being converted from constant costs into variable charges. The cattle-raiser takes care of the interest on his mortgage, the return on his equity in his farm, and the overhead costs of his own maintenance, all by selling his cattle for what they will bring per head; and the cost of live cattle becomes a variable cost to the packing house which buys them. Not only that, but it is so much larger than all the rest of their expenses put together that their own overhead becomes relatively insignificant. Packing-house labor translates its overhead costs of maintenance into a variable charge on the company, except so far as the wage system sets a minimum limit on weekly fluctuations of wages; and thus the financial expenses of packing-house products are almost all variable, though the basic economic costs are almost all constant. Be it remembered that we are speaking of the general rise and fall of business activity, and of the cost of working versus not working. The cost of doing one thing rather than something else is a different question and yields a different answer—provided there is something else to do.

The price of the live steer is a joint cost, and is allocated somehow as between meat, hides, and other products, and the hides are then sold to a tanner, thus becoming entirely a variable cost to him. After he has added his quota of overhead, and of wage costs which go to pay his labor's overhead, he sells the leather to a maker of furniture, to whom the entire sum again becomes a variable cost. When the leather finally covers the seat of a chair and is sold, the purchaser pays so much per chair to cover all these overhead costs and the series comes to an end—unless the chair is an office chair, in which case it becomes an element in the overhead costs of the business which uses the office and there begins a new cycle of shifting and conversion.

We have also seen how this shifting of costs distorts the economic reckoning when it comes to figuring whether it is economically worth while to produce goods or not. Every producer has an incentive to avoid idleness, but the strength of his incentive is measured by the amount of his own constant expenses, not by the total amount of constant costs involved in the whole process, from beginning to end of the chain of operations and exchanges. And even this incentive is weakened in its action by the fact that if one producer devotes all his usual margin of profits to stimulating demand, his sacrifice will not make a large enough impression on the whole series of outlays to produce any decisive effect.[1] Furthermore, so far as his variable expenses are concerned, he has no incentive to expand, and every incentive to retrench; and these are usually the dominant part of his budget. When he retrenches, he saves the whole amount of his variable costs, though the producers to whom this money would go do not save anything remotely corresponding to his savings, and the community saves little or nothing.

Return on investment is obviously a constant cost in such cases, and we have seen that the differential cost of labor at such times is negligible, so that labor is really a constant cost. The only item requiring further analysis here is the cost of materials. Since this includes, in principle, the cost of finished goods which a merchant buys to sell again, it is an item of enormous importance, embracing the costs of all previous processes until it includes almost all the expenses of industry by the time the goods are on the shelves of the retailer. So far as such things are perishable, the question settles itself: they must sell for what they will bring. But these perishables are chiefly raw foodstuffs and the business cycle does not center in such things; in fact, cyclical unemployment in agriculture appears to be slight.[2]

When durable materials are used, possible future uses are sacrificed. These future uses govern the present value of the material: the sum which is charged as a cost when the material is worked up. If the producer weighs costs and values correctly, he will put the materials in the form which will give them the greatest value, and at the time when they will gain the most value by being worked up. This refers, of course, to money values, but money values are the financial representatives of human needs. We are accustomed to think of prices as fulfilling this mission sufficiently well to place materials and energies where they do the most good, barring human ignorance and the inevitable distortion due to the fact that some are rich and some are poor. Where it is a case of present use against future, we are told that when speculators hold goods off the market because they expect to get a higher price later on, they are thus saving the goods until the time when the community will have the greatest need for them. And this is sometimes true in cases where the higher price does measure the greater need. But in the case of the business cycle the time of high prices is not the time of greatest need; it is the time of least urgent need, and greatest prosperity. There are not only rich and poor individuals in the community, but rich and poor periods. And the rich periods tend to outbid the poor ones for the general stock of materials, diverting them from the times of greatest need to those of greatest plenty.

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[1] See discussion in chapter ii, section 11, above.

[2] See King *Employment, Hours and Earnings*, pp. 36–46, 55.

This proposition may be stated in more general terms. When the purchasing power of money itself changes, it loses its value as a guide to the most effective use of society's stock of resources. In terms of need, the higher price does not represent the more pressing want; and if it outbids the lower price in the market, the economic system is to just that extent distorted.

Of course it is the retailer who actually supplies the consumers' needs, and it might seem that he is the logical person at whom to preach. The immediate destination of manufactured goods is always the warehouse, and the volume manufactured in a given week has little to do with the ability of dealers to supply the demands which may come in during that week. If the merchant moves the goods off his shelves, the manufacturer will fill their places. This view, however, puts the cart before the horse. The merchants' purchases fall off more than their sales, and it is this discrepancy, and others like it, which explain the greater part of the falling-off of demand for goods at the factory. And one of the chief virtues of the policy of "working to stock" is that it is the most available way to keep goods moving out of stock, into the hands of the consumers, by seeing to it that the consumers have pay checks to spend. The penalty for failing to maintain a steady flow of goods into the warehouses is a clogging of the outlet for the goods already there, and a shrinkage of their effectiveness in satisfying wants. Anything which makes goods move along more steadily, even in the early stages of production, is to be credited with helping toward a much-needed smoothing of the flow of goods into the hands of the ultimate consumer.

This policy of working to stock, then, is altogether good as far as it goes. It is of very great value in tiding over the low spots in the regular and fairly predictable seasonal cycles of demand. But the longer and less predictable hollows of the business cycle are harder to meet in this fashion. At such times, not as much use is made of this device as the health of industry requires.

To sum up: materials and unsold goods constitute a "variable cost" of production, but the market distorts its amount. As a means of distributing production and consumption over the various phases of the business cycle, money values operate in exactly the wrong direction and are directly opposed to the most efficient timing of productive activity. When a depression has paralyzed industry and crippled demand, the value of materials is greater for present working-up and sale than the market shows, while the value of holding them for future use is less than the market indicates. Thus social accounting would always either discount the "variable cost" of working up materials in time of depression, or put a premium on the value of resulting products, above the price the market offers. When a particular commodity is scarce, a high price checks its use and saves the supply against a future need which may be greater than the present. When the necessities of life in general are scarce, as may sometimes happen, a high price serves the same purpose, and speculators also further it by holding goods off the market and releasing them later when the need is still greater. It is an expensive and not altogether a just method of performing this function, but it does perform it after a fashion. But when prices are high because of prosperity, or low because of depression, their regulating effect is reversed and tends to aggravate the disease instead of curing it.

It may help to realize the effect of all this transforming of burdens in the process of shifting them, if we conceive of an industrial organization in which there would be no such shifting. If all industry were integrated and owned by the workers, what would be the relation of constant to variable expenses? Labor would then be in the position which capital now holds, and while the need of incentives to call forth extra effort or to compensate for long hours might make some wage system necessary, it would be clear to the worker-owners that the real cost of labor could not be materially reduced by unemployment. Since this is obviously true of capital, there would be little left save the depletion of natural resources which could fairly be charged as a variable cost of maintaining a moderate rate of production, when the alternative is unemployment. Partly finished goods would of course constitute a cost when devoted to further production. But for the purpose in hand, i.e., determining whether goods are worth the cost of producing them, rather than letting industry stand idle, the amount at which to reckon this cost is the differential cost of reproducing these partly finished goods. And under the given conditions, this cost would include substantially nothing for labor and nothing for capital. Even the extra wear and tear on the physical equipment would count for next to nothing, so far as it could be made good out of the spare capacity of the repair force, using time which would otherwise be idle.

"Idleness" on the part of common labor here means doing less work than the normal amount which is good for the worker, when the worker's share of the product is not beyond the requirements of adequate maintenance. For higher and better-paid grades of work, idleness would mean doing less work than one could do without thereby materially trenching upon the opportunities of leisure which one's income makes possible. Other ways of drawing the line might be more appropriate for special grades of work, or special types of temperament. But while the exact line might not be easy to locate with incontrovertible precision, nevertheless it could be drawn in a rough way, and there could not be the slightest doubt how to classify the kind of idleness which prevails during a typical business depression. It belongs under the heading: "Wasted capacity and unabsorbed burden of human overhead."

This imaginary integration of all industry has something more than a mere fictitious existence. It represents the underlying facts about the actual industrial organism, which is an integrated whole, whether its formal organization is cast in that mold or not. Nowadays the more far-seeing business men have caught a great deal of the feeling of their own dependence on the state of this greater organism, and of its dependence on the way in which their private business is conducted. This interdependence makes the social organism a reality, whether people recognize it or not, but the dawning consciousness of it makes it to some extent an active reality in its own right rather than a mere passive by-product of individual profit-seeking, at the mercy of the limitations of the money measure of human values. It means more than can be easily estimated when business men judge policies according as they are not "good social cost-keeping." It means that the thing this phrase stands for is, in its rudiments at least, already a reality and not a mere dream.

From this standpoint the integration of particular industries is a step in the direction of correct social accounting. It eliminates errors due to the buying and selling of materials, which convert the overhead costs of such materials into variable costs to the industry which uses them. But this does not go far enough. Labor would have to be included in the integration, and not stand wholly outside as a bargainer with something to sell, before the natural cost-keeping of the concern would approximate a true picture of the costs of the industry as a whole.

5. STEADYING PRICES VERSUS STEADYING PRODUCTION

One attempted remedy for the ills we have been studying is the steadying of business through steadying prices. This implies, of course, that the market is not in the grip of absolutely incontrollable competitive forces, but that someone is in a position to exercise some personal control over it. One large concern, like the United States Steel Corporation, can, within limits, control the market, and associations of smaller producers are probably able to promulgate ideas of what is economically sound or ethical or good for the trade, with sufficient force behind them to set the character of competition. Among the local merchants of a small town, there is no need of formal agreements to let the members of the trade know what will be considered fair rivalry and what will be resented as bad for the trade. Any industry which has heavy investment exposed to the danger of cut-throat competition is bound in time to develop adaptive reactions, and any industry which can protect itself against this danger must have some control over the lengths to which price-cutting goes during depressions.

Steadying industry by steadying prices is an economic paradox, since a lowering of prices is supposed to be the way to revive a failing demand. The expression may, of course, simply mean steadying dividends without regard to output, and this may be what is usually meant; nevertheless it has been seriously argued that the way to steady the actual volume of production is by steadying prices. The crux of the case lies in the claim that when prices start down, people are slower than ever to buy, because the longer they wait, the more money they save, and hence they wait for the market to reach bottom. Therefore, runs the argument, why would it not be equally effective and far less painful to bring the bottom up to the market and let prices strike bottom before they go below a normal level? If people are satisfied that prices are not going lower, they will begin to buy, not very fast, perhaps, but enough to prevent absolute stagnation.

The point is well taken; buyers do hold off when prices are going down; the fluctuations of demand are intensified by this speculative element in the market, and the natural cure for slack demand may temporarily make the disease worse. Nevertheless, if prices are ever to reach bottom they must get there somehow, and unless there is a bottom which is substantially below the top, there can never be the revival of demand that comes from the feeling that whoever buys now gets a bargain. The steadying of prices may prevent fluctuations of demand from being temporarily aggravated by the remedy employed, but instead it leaves them without any remedy at all.

A stronger argument is that by protecting the company's income, it can have money to spend on equipment and materials ahead of present needs, and so help to steady production in the industries. If all managers saw the light so strongly that they would spend all the funds they could lay their hands on in advance of immediate needs and *without even getting their materials and equipment any cheaper than if they had waited*, then—why, then we should be able to prevent the evils of the business cycle no matter what happened to prices. But, humanly speaking, it is natural to suppose that managers would be more ready to support demand in this way if there were some material inducement in the way of a bargain price.

Thus one might divide industries into two groups: one consisting of those nearest the consumer and the other of the producers of equipment and materials. The most important thing for the first group to do is to protect its income so that it may keep up its purchases and so, indirectly, protect the demand for its own products. And the most important thing for the second group to do is to give the first group a real motive to buy in dull times. Thus the steadying of prices would be largely limited to the industries nearest the consumer. To be sure, the consumer is not the kind of buyer who is much governed by speculative considerations and who holds off when prices start down, waiting for them to reach bottom; hence the chief argument for steadying prices would not apply to him. But when prices to the consumer fluctuate, wholesale prices fluctuate in sympathy. And wholesalers and retailers tend to let their stocks run low when prices are falling, and replenish them rapidly when they have struck bottom (thus starting them upward again). To avoid all this, there might be a certain advantage in steadying prices to the consumer, who in any case gets less reduction than anyone else when a depression brings prices downward; provided always that the industries which benefited could be counted on to treat the resulting earnings as a trust fund for the purpose of supporting the demand for their means of production, and thus indirectly supporting the demand for their own finished products by keeping labor at work and in receipt of pay. But in order to furnish an incentive to support the market, prices of producers' goods must come down. Complete stabilization of prices to the consumer is at best of doubtful wisdom, but stabilization of producers' prices is certainly a mistake.

Thus it appears that when the United States Steel Corporation undertook to steady prices, they were starting at the wrong point in the industrial chain. As we have seen in the earlier part of this chapter, *under perfectly steady prices there would still be great booms and depressions in the capital-making industries, and resulting booms and depressions in industry at large.* There are forces at work which translate all fluctuations of consumers' demand into greatly intensified fluctuations in the demand for the means of production, and these react back upon the demand for consumers' goods, so that the greatest fluctuations here are not original, but derived, and result from fluctuations of employment in other industries. Thus steady prices will always mean violently unsteady demand in the capital-making industries, and these will affect the rest. The only remedy for this is to induce people to spend money in the dull times for equipment which they do not immediately need, and for materials to work up "to stock." A moderate reduction of prices would be a small sacrifice to make if thereby stabilization of output were made possible.

Such reductions must be kept within bounds, or the cure will be as bad as the disease. They must not bankrupt the industry, and this means not only the employing company but the whole body of producers it represents. If the company could save its own financial integrity by passing the loss on to labor in the shape of a reduction of wages, it would still remain true that if the buying power of the laborers is seriously crippled, other industries will suffer. "Buying power depends upon both price and output, and a collapse of either—at the farm or in the factory—causes a breakdown in the exchange of goods."[1]

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[1] W. W. Stewart, *American Economic Review Supplement* (March, 1922), p. 42.

But how avoid the difficulty already raised; that when prices start down, the immediate effect is to check demand rather than to stimulate it? There is no way of conjuring this obstacle out of existence, but when manufacturers are buying materials to keep their factories going and avoid a shutdown, they will not always hold off for a small reduction in price. The best results would follow from a market in which prices, when they fall, fall quickly to a new and fairly stable level. If the power which producers have over the market could be used to bring about this kind of behavior, it would be far more useful than indiscriminate stabilization.

As for the ultimate consumer, the chief fluctuations in his demand are the fluctuations of the pay envelope, and the way to stabilize his demand for goods is to stabilize production in all departments of industry. Whatever price policy promotes this end will be the best prescription for stabilizing the consumer's demand for goods. It was once said of specie payment: "The way to resume is to resume." And it begins to appear that the way to steady production is to steady production.

6. REMEDIES FOR THE BUSINESS CYCLE

The remedies for this series of evils are dictated by the causes at work. The relieving of destitution is necessary, but it is not a cure for the disease from which waves of destitution arise. It treats a symptom, rather than the root of the trouble. Since causes at work are manifold and act jointly, the remedies must reach into various fields. Physical production, the mechanism of prices and the credit organism must all be attacked, while a prerequisite to a successful campaign is a development of the business state of mind into a hopeful, constructive, and co-operative attitude. In proportion as tangible experiments show hopeful results, this state of mind will grow and consolidate itself until ultimately even the psychological elements in the business cycle may come under some measure of control. The agencies to which we must look include government, the banking system, insurance, industry itself, and organized labor. The tactics to be adopted are some of them aimed at whittling off the peak of the boom, where it rises to altitudes at which business life cannot be sustained, others at filling in the bottom of the depression, and others at relieving distress whenever it occurs.[1]

Proposals for whittling down the summit of the boom are chiefly confined to the purely financial inflation which occurs after production has reached its limit and the only effect of further expansion is to raise the prices of goods and securities, rates of discount, etc. Since this is a financial matter, the remedy is financial, and consists in restricting the granting of credit by banks through pressure exerted by the Federal Reserve System. The most obvious form of pressure would be an increase in the discount rates, though the gamut of possible devices is a matter to be discussed by specialists and developed by experiment. The time for applying these checks would have to be determined by means of accurate and comprehensive business statistics—business barometrics which afford separate records of physical production and its financial dimensions.

It will be noted that this remedy does not propose to cut down physical production, even at the peak. Yet there is strong reason for believing that industry actually outgrows itself in terms of physical output, and that part of the growth is unassimilable and does not contribute to the long-run wealth of the country. So far as production consists of catching up with past undermaintenance and making five years' quota of new equipment in one or two years, it plainly cannot last at that rate if directed at those objects alone. And so far as it further consists in making more goods for the producers of this equipment to spend their increased incomes on, this also cannot last and would do more good it distributed rather than concentrated in boom years.

Imagine a man who owns a farm, a wood lot, a coal pit, and an iron mine, and runs a self-sufficing establishment, spinning, weaving, and making all necessary tools and utensils. He hires his laborers and sells them the goods they use, and produces whatever shows a profit. He finds that his establishment has times of great activity and other times when there is not work enough for all, and when idle hands are coming to him for support, or otherwise making nuisances of themselves. On examination it turns out that during the busy times he is making more looms, more threshing machines, more wagons, etc., so fast that if he kept on he would have more than he could possibly use. And he is also making more clothes, building larger dwelling-houses, and furnishing comforts and recreation because the additional money he pays out in wages is coming back in the form of increased demand for all these goods. And this cannot last any longer than the source from which it flows. A man in such a position would be perfectly clear that he could not always be doubling his supply of threshing machines in two years, and when he found how much trouble it made to let the workers who were dependent on this kind of work work themselves out of a job in the active period, he would probably begin scheduling this work so that he would get it done at a fairly regular rate. This would cut down the feverish activity which used to affect his whole force, but they would get just as much work done in the end. In fact, they would get more, because some of the workers in the most unsteady trades would prove to be unnecessary and would find their way into some steadier occupation.

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[1] For a conspectus of proposed remedies, see paper by W. C. Mitchell on "Controlling Business Cycles," and discussion: *American Economic Review* (March, 1922), pp. 20–43. Also the *American Labor Legislation Review* (March, 1923), which is mainly devoted to this subject, and the same magazine for March, 1922, which contains a valuable bibliography.

This is a tolerably true picture of some of the central features of the business cycle. When the manager of this enterprise started scheduling his work, he would probably begin by keeping the work going through a dull period, and making things in advance of his requirements. Then when demand revived, he could meet it without speeding up any part of his establishment to a pace which it could not maintain, or putting a demand upon it which he could not maintain. He would start by filling up the hollow rather than by cutting down the peak, though the effect might be similar in the end.

One policy tending to reduce the peak somewhat is that of making the employer bear some responsibility for the overhead cost of casual labor which he may hire, thus tending to make him reluctant to handle his peak demand in this way until he has tried his best to take care of it with the labor to which he gives regular employment. This would also tend to make him anticipate its demands as far as possible, and to postpone the least essential parts of the work which he has not been able to anticipate. One further argument for filling up the bottom of the depression rather than cutting down the peak is that it is easier to agree when a depression exists than when prosperity has passed the safe limit and needs to be curbed.

For filling up the hollows, the most positive and definite prescription is that government should plan an elastic schedule for public works of a postponable sort, and should save certain works to be prosecuted only in time of depression and unemployment, or prosecute the entire program more actively at such times. There is no need to argue the merit of this plan, for it is self-evident, especially after what has been said as to the causes of booms and depressions. It goes to the root of the matter, and the only debatable questions are those of ways and means for carrying it into effect. It has also been suggested that this same principle could be applied to the purchase of the more standardized sorts of supplies, if funds were available to buy them ahead of the need.

Of course these elastic budgets must be financed, and the revenues of governments shrink somewhat in dull times, especially those which come from indirect taxation. But between the setting aside of funds in good time and the use of banking credit, the thing could be done without any serious difficulty. In Germany since the war, governments have financed the employment of hundreds of thousands of workers engaged in building roads, making gardens, reclaiming moorlands, completing the Berlin subway, building and repairing houses, and in many other kinds of work of general usefulness. Much of this labor works for private employers and contractors, with some necessary measure of public oversight.[1] And if Germany can bear the financial burden, richer countries can certainly do so.

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[1] See "Productive Unemployment in Germany," *Survey* (December 24, 1921), pp. 463–65.

Still more could be accomplished if the resources of private industry itself were enlisted in the same cause, and this will be done as fast as private industry comes to feel and to bear, toward the joint overhead costs of the industrial organism, responsibility commensurate with its powers and opportunities. Railroads, for example, could do more in this direction than any other single agency, if they definitely undertook the task and had funds to carry it out. In the words of one writer: "The fact is that the state and the nation cannot get a grip of any kind on the unemployment problem until the capitalist has first discharged his obligations and responsibilities in the premises. When that is done the residual problem for federal or state action will not be a serious one in a rapidly expanding civilization like ours."[1] Systems of unemployment compensation are included in this program as means of making it worth the employer's while to stabilize work in his own establishment.

It has also been suggested that this common peril of depressions would require some common organization to meet it, and to exercise control of the strategy of business as a collective organism, in somewhat the way in which the Federal Reserve System controls the grand strategy of banking, while leaving each bank to manage its more strictly private affairs.[2] If prediction in social matters is ever justified, it is worth hazarding the prophecy that some day such a vehicle of economic statesmanship will be a reality, though from the present perspective its form and jurisdiction can only be conjectured. With such an organization in existence, social cost-keeping would gain a definiteness which is hardly possible today.

The most probable first task of such an organization grows out of unemployment insurance, which bids fair before long to become a recognized part of our economic machinery. Such insurance should, so far as possible, give every employer a chance to lower his rate of premiums by improving the regularity of employment in his own establishment. If it does not do this, employers as a whole will still have a collective interest in reducing their burdens, and a collective organization will be the natural means of making this interest effective. Even if the employer's individual interest is directly enlisted, guidance and co-ordination will still be vitally needed, and these needs will justify a collective organization. With this in existence and with labor given some effective degree of partnership in individual enterprises, we shall perhaps be on our way to the development of a federated economic state which may take over some of the burdens of economic control which now rest over-heavily on the shoulders of our somewhat ill-adapted political organization. But that is too large a prophecy to enter on at this time, and far transcends the limits of a study of overhead costs.

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[1] John Calder, "How the Employer Can Safeguard a Man's Job," *Survey* (October 15, 1922), p. 95.

[2] See W. W. Stewart, discussion in *American Economic Review Supplement* (March 1922), pp. 42–43.

Other auxiliary measures include a better co-ordination of employment offices, and better statistical indexes of business conditions. Business is moving in the direction of funding its stock of private knowledge and so making the "intellectual overhead" far more effective than at present. Another project is the stabilization of the dollar, so ably and indefatigably advocated by Irving Fisher. From what has already been said it appears that absolute stabilization is not desirable; that there should be some room for the prices of producers' goods to fall, and so give industry and government an incentive to buy and build ahead of demand, in dull times, without compelling the prices of other things to rise enough to maintain a fixed average. However, the longer swings of prices do nothing but harm, and the plan proposed by Professor Fisher could be so adjusted as to counteract these longer swings without being so quick and strong in its action as to prevent minor ups and downs which might perform a useful function. Indeed, it might not prove practicable to prevent these minor and temporary swings of particular groups of prices from producing their natural effect upon the average level.

One of the things most needed in order to cure the business cycle is confidence that it can be cured, just as one of the things most vital to maintaining banking solvency is confidence that it can be maintained. Such confidence can only come as the result of successful measures of a more tangible sort, which means that the effect of such measures will be cumulative; they will progressively diminish the resistance they have to meet and their first task will be the hardest. And it will not be necessary for government or other curative agencies to find or furnish work for all the four million and more whom depression throws out of work. If part of them are employed, these will employ others to make goods for them, and these in turn others. The saving grace of this chain of cumulative disturbance is that it will work cumulatively in both directions. But for this, the task might well appear hopeless. As it is, the only conclusion to which an unbiased mind can come is that it is economically possible to cure the worst evils of the business cycle, and that a correct comprehension of the character of social overhead costs will play a large part in the remedies which should effect this cure.

7. REACTIONS AND CONSEQUENCES

If production is regularized, there will be a great release of productive energy which now goes to waste, and if this were to happen quickly, there would arise a serious question how we should use our new power, and what realignments of production we should have to make in order to keep a proper balance between extractive industries furnishing raw foodstuffs and materials, steel-making, machine-making, and other capital-making industries, and the making of goods for consumption. One saving feature is the fact that the fundamental metal-working equipment is fairly adaptable, and can be used, with some alterations and adjustments, to produce new kinds of tools and machines. One typical example of the kind of outlet available for released energy might lie in keeping the world's supply of petroleum up to the incredibly growing demands of transportation for gasoline and fuel oil. There might, however, easily come to be an oversupply of some kinds of productive equipment.

One remedy for this would be, instead of multiplying the supply of the same kinds of machines now in use, to put capital into more refined forms, so that each laborer would have better equipment to work with. This is the kind of adjustment in the "proportion of factors" which is inevitably required to absorb a supply of capital which increases faster than the working population. Such an adjustment means a reduction in the productive value of the capital, and investments in this form could not pay the customary rate of interest on the present cost of equipment. But either a reduction in the price of equipment, or of interest rates, or both, would make a substantial growth of such labor-saving investments economically practicable.

One trouble with the economic system lies in the unimaginative way it has of sticking to the kind of investments which are customary and multiplying the number of machines, when it is open to question whether there is labor enough to work them all to capacity and to feed them with materials over a term of years. Such investments promise the usual yield, but often they become superfluous as soon as the boom has died down—the boom of which they were themselves partly the cause. Then they yield nothing, and may yield less than nothing from the community point of view, by dividing the labor supply up among too many plant units, none of which is working at effective capacity. This wastes labor and produces an unnecessary duplication of indirect expenses.

On the other hand, the same amount of capital put into new forms of machinery which would give $1,200 worth of equipment to the same laborers who now work with $1,000 worth, might yield a low but permanent return. If the makers of machines sold the $1,200 worth of equipment for $1,000, or even $1,100, for the sake of maintaining production through dull times, and if the banks would lend capital at low rates for such purposes, the combined effect might bring a considerable volume of such equipment into the realm of worth-while investments. There is some reason for thinking that the customary interest rate is higher than the marginal productive worth of capital justifies, measuring it by the amount of funds the investors and the credit mechanism are able to furnish, or by the amount of capital appliances which the industries devoted to that purpose are capable of turning out. But that is a trail which would lead us far afield. In any case, where investments are being made to keep industry moving rather than out of an urgent pressure for profits, there should be more willingness to put capital into these conservative forms which will yield their return in lowered operating expenses on the existing output, rather than in multiplying output, to the quick glutting of the markets.

8. CONCLUSION

The business cycle is one of the most many-sided of economic questions, and this discussion, brief and inadequate as it is, and devoted mainly to matters of overhead costs, has nevertheless covered such a wide territory that a simple summary is well nigh out of the question. We have seen that the dependence of profits on sales, and the timing of capital expenditures, are two facts of the first magnitude as causes of our uncontrolled fits of alternate energy and paralysis. We have seen that private financial accounting distorts the relative amounts of constant and variable costs in industry, making it seem that most of them are variable when in fact, with reference to this problem, most of them are constant. We have seen that a sense of community accounting and its significance is dawning, and that it is in direct conflict with the short-sighted policy of stabilizing prices, protecting the earnings of capital (the only overhead which old-fashioned accounting recognizes) and letting production fall off and the evils of unemployment accumulate. And we have seen that there is a list of remedial measures, financial and industrial, private and public, which offer a real hope of substantially eliminating this, the greatest waste of "idle overhead" in modern industry.

CHAPTER XX

DISCRIMINATION IN THE MODERN MARKET

SUMMARY

The nature of the market, 416—Dumping, 420—Discrimination between localities, 423—Different classes of buyers, 425—Discrimination between commodities, brands, and grades, 428—Discrimination according to service, accommodation, or time, 430—Makeweights in the bargain, 431—Conclusion, 432.

I. THE NATURE OF THE MARKET

If one had to choose a motto of six words, expressing the most central economic consequence of overhead cost, the first choice might fall upon some such phrase as : "Full utilization is worth its cost," but a close second would be: "Discrimination is the secret of efficiency." This last, to be sure, needs to be taken with a proviso: one must know where to stop. The economic basis of it is simple. Existing business may or may not cover all overhead costs, but in either case, if there is spare capacity, added business will cause no added overhead, and will be a gain at anything above differential cost, *so long as it can be kept separate from existing business*, so that existing earnings are not impaired. This leads to a system of making each separate section of the business pay the largest possible yield above differential cost. A "section of the business" may mean a single customer or a single sale, but, in general, classification is limited by the extent to which business convenience makes it practicable, or public sentiment makes it prudent.

For discrimination is not solely an economic fact. It raises moral and social issues: it is the tool of favoritism and greed and the vehicle of the highest social justice. It may rouse our righteous resentment or our admiring commendation. So far as overhead costs are concerned, the rôle they play is passive; they permit discrimination: the pursuit of maximum profit impels men to discriminate, and most of the other motives known to man join in at one time or another, playing a part and modifying the character of the result.

Economists are accustomed to assume that under competition there can be but one price at one time in one market. This assumption is partly the result of observation, for markets do show a tendency to iron out inequalities in prices, and partly an a priori premise, growing out of the fact that the economist's study of the laws of price has been cast in the mold of a search for the natural level of prices; thus assuming that there is some natural level toward which the different prices in a market gravitate. We have recently witnessed an interesting practical commentary on this assumption, when the Federal Trade Commission, attempting to prove that restraint of trade exists in the meat-packing industry, cited as evidence the fact that the different packing-houses all pay the same prices for live cattle, and the representatives of the packers replied that this is the traditional symptom of a perfectly competitive market and only goes to prove how keen the competition in these markets is. Both sides, it may be remarked, employ professional economists. Which is right?

Without attempting to prejudge this particular issue, on the general question the truth appears to be that the regular operation of a competitive market implies that some take the lead and others follow, and unless there is an appreciable interval during which prices differ it is difficult or impossible for those who take the lead to gain any advantage by the typical competitive tactics of raising their prices for things they wish to buy, or lowering them on things they wish to sell. The gain consists typically in selling more goods at the lower price. This is something a monopoly could also do, but competing concerns are supposed to have more of an incentive to cut prices than monopolies have. If all the competitors followed suit instantly the moment any cut was made, each would gain his quota of the resulting increase in output, and no one would gain any larger proportion of his previous business than a monopoly would gain by a similar cut in prices. Thus the competitive cutting of prices would naturally stop exactly where it would if there were no competition.

The distinctively competitive type of gain comes from getting more than one's former quota of the business: getting all the new business which the reduced price brings forth, or getting business away from one's competitors. This gain takes place chiefly in the interval after the customers know of the reduction of prices and before they become aware that competitors have followed suit. This rests on a further condition, namely, that it takes an appreciable time for the customers to transfer their trade. If they all moved at once, the first competitor would have all the trade, provided he could handle it, leaving nothing for the others.

Often he does get all he can handle, and the others, for the time being, content themselves with what is left over. This is in cases where goods are standardized and "competition centers in price," so that a slight differential is decisive. More often, however, there are questions of quality to be considered and many customers keep on buying the brands to which they are accustomed, so that the effect of a reduction of price by one competitor is cushioned and retarded. In a sense each competitor has a monopoly of the difference in quality (real or supposed) between his goods and his rivals', and this qualified monopoly is a feature of the typical "competitive" market. This gives the trade time to observe how serious are the inroads which the initial cutter of prices succeeds in making, and to decide whether it is necessary to follow suit. And this interval gives the initiator of the movement his chance to enlarge his business and make what may be a permanent gain, provided he has not overreached himself and set prices lower than his costs will justify.

Thus the retarded action of the market which permits different prices to prevail at the same time is not really an "imperfection," as theoretical economics has been inclined to regard it. On the contrary, it is an essential requirement, without which it could not produce its characteristic effects. It means that, to a limited extent, each producer has his own individual market, connected more or less closely with those of his competitors, so that discrepancies are limited in amount and in duration, becoming narrower and briefer in proportion to the standardized character of the goods.

Large-scale manufacturing adds further structural complexity to the market, for it means that a single concern sells goods in nation-wide markets. A nation-wide market is really a system of markets so connected by railroads and telegraph wires that prices of standardized goods cannot differ for long by more than the cost of transportation, plus enough margin to pay for the trouble of a simple shipment and sale. Some markets of this kind show such a systematic organization that it is virtually possible to tell what the price is in any part, if one knows the price in some other central part, and also the costs of transportation. Thus it is customary to say that Liverpool is the world's wheat market, and that prices elsewhere are governed by the Liverpool price plus or minus the costs of transportation, according as the place is one which sends wheat to Liverpool, or receives it from that center. This regularity is the natural result of unfettered trading, not of any direct policy of men.

But markets for manufactured goods are not naturally so systematic. Suppose that three large manufacturing concerns, in widely separated places and with different costs of production, are competing for a nation-wide market. The situation is a trifle like Argentina, Canada, and Australia furnishing the world-market with wheat, but there are some important differences. In the first place there is no home competition for the manufacturer in his own district, only the distant competition of a rival shipping from another region. Hence he can, if he chooses, keep his price higher in his own town than in neutral territory by adding the cost of transportation his rival would have to pay, instead of making it lower by subtracting the freight he is saved from paying himself. In the second place, there is not the semi-automatic adjustment which exists in agriculture, whereby if one region can raise wheat at a low cost of labor and other elements, cultivation is intensified until diminishing returns set in and the marginal cost roughly adjusts itself to the price, while land rents absorb the surplus and convert it into a cost of production. In manufacturing, each establishment has its cost and its profits and there is no margin at which they all become equal and no landowner to capitalize the profits of the more efficient concerns and call them his.

Under such conditions, the natural price in any one part of the market will be hard to determine. Goods from each center of production can be laid down there, at cost of production plus transportation, and the price will generally be high enough to let in all three producers, giving the most favored one a profit. Add to this the fact that all of them have overhead costs, so that cost per unit falls as output increases, and the price situation becomes thoroughly indeterminate. Each producer can afford to enter his rival's territory and sell an additional lot of goods there for less than he can afford to take as an average on his whole output, and the result cannot be foretold by calculating what each would do if he were an "economic man."

2. DUMPING[1]

Where distances are short and costs of transport low, discrimination is kept within narrow limits, because anyone in the favored market can buy the goods cheap and ship them into the markets where they are dear. It is only the very distant consumers, generally in foreign countries, who, just because it costs so much to get the goods to them, can get them very much cheaper than people who live near the factory. This is, of course, an inverted way of putting the case. The goods are not sold cheaper because of the freight they have paid, but they can be sold cheaper if the producer wants to, without coming back and spoiling his home market, because of the freight (and duties) they would have to pay to make the return journey. Which comes to much the same as saying that the freight on the foreigner's goods is subtracted from the price he pays instead of being added.

When the foreign consumer pays an absolutely lower price than the home buyer, there can be no doubt that the business is either a monopoly abusing its power by exacting a heavy monopoly profit, or else it is a business in which constant costs are decidedly heavy. The typical objections from the home consumer are that if the lower foreign price is profitable, the higher domestic price must be extortionate, and that the producer is keeping up the price at home by disposing of surplus goods abroad. To this the answer is made that the foreign sales yield something above differential cost, so that they relieve home sales of part of the burden of overhead costs, and that if the goods were not "dumped" abroad, the home price would have to be still higher, rather than lower, because the home market would have to bear all the overhead which now the foreigner helps to bear, even if he only helps a little.

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[1] For a fuller discussion of this subject, see Viner: *Dumping in International Trade*. University of Chicago Press, 1923.

Where does the right of the argument lie? Before trying to decide, one thing must be noted which distinguishes businesses of large constant costs. Ordinarily it is thought that a monopoly, charging the price which yields the greatest profit, will make some profit above the cost of production. To some this proposition seems absurdly self-evident. Nevertheless it is not true. The most profitable price is such a price that the margin above differential cost (not average cost), multiplied by volume of sales, will be a maximum. If the business has large constant or residual costs it may not be able to cover them, do what it can. The "maximum monopoly profit" may fail to cover all the overhead outlays. Not that such a case is typical: it implies overinvestment such as a monopoly would not willingly be guilty of. Thus it is likely to occur only where the monopoly is one which has been formed to cure the ills of an unduly competitive trade, afflicted with too much producing capacity, or else where a plant has been built from other than purely commercial motives, such as the Panama Canal, or, possibly, the Virginian Railroad. In any case, where constant costs are large, monopoly price is likely to be quite near the level of competitive price, especially where the demand is decidedly elastic. The competing concerns themselves have to make a considerable margin above the differential cost of production in order to cover their legitimate overhead, so that the difference between the two cases may become quite slight.

It also makes a difference whether the dumping is seasonal, intermittent, or a permanent policy. Any concern may have a seasonal surplus of capacity, and sales in foreign markets, especially in the Southern Hemisphere where the seasons are the reverse of ours, may be the most legitimate method of regularizing output, keeping the organization together and preventing idle overhead of labor as well as capital. Where dumping is a permanent policy, the differential cost of the goods cannot be figured in quite the same way, for in the long run any such large section of output occasions overhead costs of its own and should be charged with them. If a plant has so much unused capacity that the growth of the home market, even over a period of years, will not absorb it, it must be a very large plant indeed, so large as to have some measure of dominance over the market. And if there are a number of smaller plants, all in the same condition, and each of them dumps its share of the surplus above what the home market will absorb, this argues a considerable degree of concerted action, since any one concern could always make more money by selling a little less abroad and a little more at home where the price is kept higher. To refrain from doing this implies acting in the interest of the group rather than for purely private profit, and this in turn implies that the home market is not entirely a competitive one.

The best construction which can be put upon this situation is that there is surplus producing capacity in the industry, which would naturally result in a condition of "cut-throat competition" if competitive forces went absolutely unchecked, and that they are checked by a general sentiment against "spoiling the market," which sets an informal sort of limit on the cutting of prices at home, that the larger concerns bear the chief burden of stabilizing home prices, with the result that they are not able to market as large a percentage of their capacity there as the smaller concerns, and that they make up for this by using the foreign market as a dumping ground, a resource for which the smaller concerns have not sufficient capital. In a situation such as this, the effect of dumping on domestic prices is very difficult to determine.

If this outlet did not exist, the large concerns would find their tolerant attitude toward the smaller ones more expensive and the result might be fiercer competition. Or the fear of such a competition might serve as an argument to persuade the trade as a whole to abide by a higher level of prices, under which the larger concerns could do as well as before. The situation here described is an ambiguous one, neither strictly competitive nor strictly monopolistic, but it is precisely the kind of situation likely to result from the influence of overhead costs. If the home market were given over to unchecked competition or to absolute monopoly, it is difficult to see how the price could be materially affected by dumping, either for better or for worse. As it is, the answer is indeterminate, like so many of the answers to problems of price where overhead costs play a part.

Another possibility is that the producers have power to exact the prices which would yield the maximum monopoly profit, but refrain from doing so out of charity, fear of public action, or some other motive. This idea is implied in much that is said on such topics, and might be called the "ashamed-to-take-the-money" theory of value and distribution.

From the point of view of the foreigner, the chief objection to dumping arises from the fact that the cheap supplies cannot be relied on forever. Otherwise producers and consumers alike could adjust themselves to the blessings which the legerdemain of cost-accounting conjures into their laps, and the nation would be richer by the use of goods whose overhead costs they are not required to pay. Where the goods which are dumped are raw materials, foreign producers may fatten their profits by using them, and perhaps sell the products back to the country from which the materials came. Producers who have to compete against dumping feel a grievance, especially as their markets are flooded at just the times when demand is weak and their efforts at stabilization are hampered. If the foreign country wishes to be self-sufficient it may be worth while for it to bear the immediate sacrifice involved in excluding goods which others wish to dump upon them.

3. DISCRIMINATION BETWEEN LOCALITIES

The principles of dumping apply also to domestic trade, but within narrower limits, since freight rates are lower and there are no customs tariffs to prevent cheap goods from returning to flood the protected markets. Within these limits, the geographical structure is capable of taking one form or another according to the policy of the larger concerns—witness the long-standing controversy over the system whereby the price of steel is fixed at the Pittsburgh price plus freight to destination, no matter where the steel is actually made. Here is a market based on a central point as the wheat market is based on Liverpool, but it is a producing instead of a receiving point, and the structure is not dictated by any such inevitable competitive forces as those which shape the wheat market. Other typical structures include the sale of branded package goods at a uniform price to the consumer, disregarding costs of carriage, the meeting of local competition wherever it exists, and the differentials which exist between cheap and dear stores in cheap and dear retail districts.

The chief abuse involved in local discrimination is its deliberate use by a monopolistic concern to stifle growing competition.[1] This latter practice has apparently subsided into a weapon for disciplining the trade and keeping it in order: an intermittent warfare designed to penalize independent concerns who cut prices too low and so abuse the tolerance with which the larger concerns commonly treat them. This deters them from "spoiling the market," but does not threaten their lives nor their formal independence. As a result, the need for reforming this practice has lost some of its former urgency. Nevertheless, just as the one-price system in retail trade proved far more efficient and better for the trade as a whole than the older method of separate bargains with each customer, so some system of uniformity will undoubtedly prove better for national markets as a whole, in the long run. Where the producer whose territory is invaded is strong enough to fight on fairly equal terms, there is a natural check on undue cutting in his particular market. He may or may not meet the cut—it is expensive to do so—but he can retaliate by a counter-invasion of his opponent's home market. Many concerns of fair size, even when they have a well-defined market, feel that it is good policy to maintain "outposts of competition" in their rival's markets. Whatever the reason or justification for this, it does put them in a position for quick retaliation if the rival starts a poaching campaign, and this prospect undoubtedly acts as a deterrent to irresponsible local discriminations.

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[1] This subject has been discussed at some length by J. B. Clark, *The Control of Trusts*, 1907 (revised edition, 1912, by J. B. and J. M. Clark). Also J. B. Clark, *The Problem of Monopoly;* and Stevens, *Industrial Combinations and Trusts*, and *Unfair Competition*.

Such discriminations have little value in developing new business. They serve chiefly to determine which competitor shall secure the larger share of the existing business. And the consumer receives a doubtful benefit, just as in international dumping, because he adjusts himself to a privilege which may vanish as easily as the wind changes, and is not likely to yield him long-run benefits.

4. DIFFERENT CLASSES OF BUYERS

The most obvious case, perhaps, is the classifying of buyers into wholesalers, retailers and consumers, but this is not true personal discrimination. These classifications correspond to real differences in the character of business involved. There is a saving in overhead in selling to retailers as compared to consumers; and to wholesalers as compared to retailers; and the regular systems of discounts have something to do with this saving of overhead, though the question in the manufacturer's case quite as often takes the form of protecting the regular dealers in the margins which they need to cover their overhead costs. In the long run there is probably not a great deal of difference between these two ways of figuring, as the manufacturer cannot do his own wholesaling nor the wholesaler his own retailing without largely duplicating the equipment and expenses of the independent dealer, but it is decidedly important that this question should be left open to the test of the freest competition, with no artificial handicaps.

Therefore the spread between the prices at which a producer will sell to wholesalers and to retailers should be governed by the relative cost to him of the two classes of business, not the supposed cost to the independent wholesaler, who desires protection against direct buying on the part of retailers. One glaring abuse of these discounts occurs when co-operative enterprises, which perform the functions of retailers, are classed as consumers and refused the regular retailers' discount. This is a clear case of setting up a barrier against legitimate competition, and any such tactics tend to give rise to a suspicion that our mercantile organization is not wholly competitive and enjoys wider margins than would be possible under free competition of rival methods.

The seller of a service can classify purchasers according to the use they make of it, for example, electricity for power and for light. Here there is a real difference in the cost of the service rendered for these two purposes, but the same device may also be used as a means of marking off a class of customers, merely because they will stand a higher toll. The Interstate Commerce Commission has refused to permit railroads to make discriminations on this ground alone, though often the class designation of goods is not unmistakable, and use may enter in in determining it—for example: Are cowpeas peas or fertilizer?

Discrimination between classes of buyers may also be concealed in charges for real or fancied differences in the quality of goods. A grocer takes prunes out of the same lot, divides them into two different lots at different prices, perhaps glazing one with a wash of thin syrup, and very likely sells the more expensive lot the faster of the two. Identical goods are sold in packages and in bulk at prices which make the containers wonderfully expensive. The most expensive editions of a book are used as a method of finding those levels of demand which will pay a high price, and giving these taxable customers the opportunity to be taxed This is all the more effective if the more expensive edition comes out first, for it then extracts the high price from everyone who particularly wants the book while it is fresh, and from many who would always buy the cheaper edition if they had a choice. After the upper levels of demand have been thoroughly explored, the cheaper editions appear. Their cheapness is only secondarily a matter of paper and binding; it is primarily a case of charging what the traffic will bear.

Another simple method of segregating classes of consumers is followed by department stores which instal a cheaper grade of store in the basement, with less spacious accommodations, and a less expert selling force, where they dispose of remnants, as well as carry cheaper lines of goods. Here the element of classifying the market is no more important than the utilizing of waste space, putting relatively inexperienced salespersons where they can make large sales without getting in the way of the more fastidious trade, and can move the remnants and "stickers" without forcing the élite of the sales personnel to misspend their time on that secondary function.

New and old customers, or regulars and transients, may also be differentiated. The low rate made by magazines to secure new subscribers is a well-known example, and the same thing is often done in selling other kinds of goods. If the old customer is steady and the new one is likely to be transient, this may furnish a ground for treating the established customers with special consideration: but aside from this the tactical advantage is all with the one new buyer whom the concern is trying to lure. A little thing may make all the difference between gaining his custom and losing it, and there is more trouble taken over him than over the ninety and nine who need no special inducements.

This is one way of disregarding overhead costs to enlarge sales, while making them up on the established business. "Special offers" of all sorts come in this class, and are meant to catch the reluctant and wavering buyer. But there is no end to the devices which may be used to accomplish this purpose. "Goods are put out without the usual brand, or are sold surreptitiously to a few favored purchasers, with stipulations against resale, or requirements concerning resale prices."[1]

Another form of discrimination is the discount for cash. Generally a concern chooses one of two policies: to make no discount at all, or to make the discount in the form of a lump sum, a great deal larger than the interest which the customer ordinarily saves, and so furnish a powerful incentive to pay in time to get the discount. It is chiefly large concerns selling goods on the instalment plan which calculate discounts according to the time the debt runs, and at something approaching a market rate of interest.

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[1] F. W. Taussig, "Is Market Price Determinate?" *Quarterly Journal of Economics*, XXXV (May, 1921), 410.

One of the simplest forms of discrimination occurs where a doctor or lawyer grades his fee according to his client's pocketbook. This is only partly a method of enlarging their trade for the sake of greater profit, since the doctor, at least, often serves for nothing. This kind of discrimination is a bit of social adjustment more than a money-making policy. It tends in the direction of neutralizing the extra buying power of the rich over one of the most expensive and most necessary services. And the poorer section of a doctor's practice obtains medical service which it could not pay for unless the doctor were allowed to collect most of his overhead from the rich. If more goods and services could be sold on similar principles, the rich would be quite as happy and the poor would have more of the necessities of life, without confiscating wealth or disturbing the system of scoring in our great competitive game wherein a man's success is measured by his money income.

Other forms of discrimination are still more personal, such as the free passes which used to be so common on railroads, and similar perquisites in other businesses in the form of discounts to those in the trade, and perhaps to some of their friends. Some forms of this will probably go the way of old-fashioned retail higgling, while others may make a permanent place for themselves. Where they cheapen the general necessaries of life to all the employees, they may be taken as a desirable part of the real wages the concern pays, and a limited approach toward a co-operative system. Where they concern non-essential goods, and are granted only to officers or those in commercial positions, and extended by courtesy to their friends, the industrial world could do quite as well without them.

5. DISCRIMINATION BETWEEN COMMODITIES, BRANDS, AND GRADES

One of the simplest and most common kinds of discrimination occurs through failure to discriminate: that is, charging flat amounts where cost and service rendered both vary. Retailers commonly charge a customary percentage above what the goods cost them. This discriminates in favor of goods which use large amounts of expensive space, goods which are turned over slowly, and goods which require much work to sell, either because they are hard to move, or simply because people buy them in such small lots. Where sugar is sold by the pound without discount for quantity, the result is to discriminate heavily against anyone who might wish to take 25 or 50 pounds in one purchase. One investigator estimated that selling, handling, and delivery cost about $1.90 for 100 pounds of sugar as it was actually handled, while if it were possible to sell a 100-pound sack as a unit, the cost would be about 14 cents. As the spread between wholesaler and retail prices was $2.00, there was only 10 cents left for the retailer's overhead, and the possible gain from selling the same amount of sugar in fewer and larger packages might be quite material.[1]

The margin or spread charged by the retailer is by no means rigidly uniform. Sometimes it varies widely with no apparent correponding variation in the cost of handling the goods. A more systematic discrimination consists in treating certain goods as "leaders," giving the customer a more than usually good bargain on those particular goods, and seeing to it that the fact is brought to his attention. One effect is to attract people into the store for one bargain and then sell them other things. A "leader" needs to be something whose quality and prevailing price are well known, or else it needs to be thoroughly advertised. A particularly grandiose stroke is to sell some universally known branded commodity, such as Ingersoll watches or Gillette safety razors, at less than the actual cost of the goods themselves. This, of course, goes beyond the limits of an optional distribution of overhead, and becomes an out-and-out gift or premium. It is also an injury to the maker of the goods, since it casts unjustified doubt upon the fairness of the standard price. In such cases the fixing of resale prices may prevent a genuine wrong.

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[1] Based on an investigation of retail grocery stores in Portland, Oregon. Reported to the writer in 1923 by Miss Dorothy Poor, a graduate student at the University of Chicago.

"Stickers" have already been mentioned: the goods which have failed to move after a reasonable time, and are taking up shelf room which should be occupied by goods that will move faster. The goods cannot easily be made to pay the overhead costs chargeable against them for the past, and if they are not moved somehow, they will eat up a deal more overhead in the future. One rather short-sighted method is to give salesmen a premium for selling such goods, thus bribing them to divert their best efforts from the best goods, toward getting doubtful goods into the consumer's hands—goods which will probably not greatly help the reputation of the concern. As already suggested, a markdown sale in the basement is a more appropriate remedy. It is usually better to accept the verdict of the public as to the value of the goods rather than to fight against it by concentrating selling effort in just those spots where it has the least promising materials to work with, and can do the least real good.

6. DISCRIMINATION ACCORDING TO SERVICE, ACCOMMODATION, OR TIME

Other types of discrimination arise in fixing prices for the different rooms of a hotel, the different seats in a theater, upper and lower berths, and other similar accommodations. The difference in price is not chiefly a question of cost, but of utilizing capacity and adapting the price to the public's desire for the different parts of the service. These cases are really on the borderline between the general problem of utilizing a given capacity, and the special principle of "joint cost." So far as the accommodations are essentially different, and costs cannot all be definitely allocated to them, there is ground for claiming that charging different prices is not discrimination at all.

However, there are still the convention rates at hotels, "popular-priced" concerts, educational discounts to help fill up empty seats at improving plays which are not quite good enough to entice the public away from musical comedy, and the regular discrimination between afternoons and evenings and the different days of the week, or the whole field of seasonal rates. Even the charges and privileges at golf courses show some differentiation in recognition of unused capacity and a varying load. Into all these different types of practice it will be impossible to carry our study. They do not raise questions of serious public import, but they do illustrate the principle we have been discussing, and they show how thoroughly widespread and general the practice of differential price-making is.

7. MAKEWEIGHTS IN THE BARGAIN

Discrimination may take the form, not merely of lower prices but of credit, delivery, and other services, or of devoting more or less selling effort to the same goods without change of quality, service, or price. The grocery store is discriminating when it charges the same price with or without delivery. One of the subtlest forms of discrimination is that of the retailer who insinuates into the hands of the customer the brand of goods on which the manufacturer allows him the widest margin. The manufacturer is paying for salesmanship, or rather for the special favor of a salesman who is ostensibly neutral, and who needs to be neutral if the customer is to get reasonable access to the market. If the bargain were made in the open there would be little objection to it which would not apply to our whole selling system, for the producer regularly has the option whether to spend money on his selling force or apply the same amount to the reduction of prices. As it is, it warps the proper function of the retailer. He should either be the known agent of one concern or the keeper of an impartial market for the goods of all—preferably the latter in general retailing.

"Service" has many aspects. The service of selling is branching out into demonstration, education, and even disinterested advice. One interesting type of problem arises in connection with such things as automobiles or washing-machines. Is the producer supposed to sell a machine only or the service of a machine-that-goes? If the machine does not work exactly right, is that because the machine was not quite as good as others of identical brand, or because the owner has abused it, or because it needs occasional adjustment in the ordinary course of operation? And in the latter case does the need of adjustment vary with the care and skill of the operator, or with the imperceptible variations in the workmanchip of the machine itself? And should the customer be expected to make the adjustments, or hire them made, or will the producer be able to sell a more valuable service, and profit more in the end, if its own agents who, presumably have the proper working of the machine at heart, shall make all such adjustments and take the responsibility for keeping the machine in running order? Truly a heavy responsibility, so long as mechanism is not made absolutely "fool-proof." Free repairs are often guaranteed on condition that the user follows the printed directions accurately. This is an entering wedge, for there is strong pressure to give the consumer the benefit of the doubt and to repair damages for which his own clumsiness is really responsible.

Here there is a wide margin within which it is not possible to say what is discrimination and what is equal price for equal service. The amount of free service rendered in such cases is a testimonial to the growth of the idea that what is sold is not a physical aggregation of pieces of metal, nor even an aggregation which will run if treated precisely right, but a service of operation, maintained through at least the minor vicissitudes and chances which occur when the ordinary inexpert human being is put in charge of an unfamiliar mechanical servant.

8. CONCLUSION

It is well-nigh impossible to summarize all the varieties of differential price-making which are found in business. Where the different bargains are so offered that the buyer has a really free option and therefore classifies himself, there is little chance for abuse and much room for general benefits. The chief public requisite is that there should be adequate knowledge of the quality of goods and services offered, so far as differences in quality are of serious human importance. Minor differences used as pretexts to extract extra dollars from those who can afford them may be passed over as of little public significance. Where the discrimination merely transfers trade from one competitor to another, it does little to develop greater usefulness in the industrial equipment as a whole, and has little positive value. Local discriminations belong for the most part in this class.

In general, discrimination is not a sure symptom of monopoly, still less of extortionate prices. Nor is discrimination necessarily due either to monopoly or to "joint cost." It is a natural result of overhead costs, and is found in practically every phase of business. Sometimes it is due to close figuring of costs and keen pursuit of profits; sometimes to ignorance of costs or failure to allocate them. It needs no elaborate explanation; rather, when it is absent, its absence needs explaining. On the whole, however, the more uniform prices become, the less does selling effort spend itself on the bargaining aspect of its work, and the more does it tend to focus upon real service and to make itself indispensable to the consumer by furnishing genuine and valuable guidance. Accordingly, the market will be in a better condition in proportion as it sloughs off all discriminations except those which have a clear tendency to tap strata of demand which would otherwise remain untapped, and to develop uses of our economic equipment which would otherwise remain unexploited.

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CHAPTER XXI

CUT-THROAT COMPETITION AND THE PUBLIC INTEREST

SUMMARY

The dilemma of industry, 434—The supply of productive capacity, 437—The meaning of "spoiling the market," 439—Potential competition as a limit on prices, 444—Is competition ruinous? 447—The social interest in production versus the private interest in profits, 448—Conclusion, 450.

I. THE DILEMMA OF INDUSTRY

Some writer has said, speaking of railroads, that there can be competition somewhere, competition everywhere, or competition nowhere. Competition somewhere spells unfair discrimination; competition everywhere means cut-throat competition, and competition nowhere is industry's only refuge. It is this three-horned dilemma which now invites our study. The difficulty has another phase, for we have seen that the public interest calls for production, whenever the normal capacity of industry is not fully used, turning out any goods which are worth the differential cost of making them. We have also seen that this differential cost is, socially speaking, next to nothing at times of general idleness, and therefore if industry follows this rule to the letter, it cannot possibly cover its overhead costs. If it can discriminate it will be much better off than if it has to sell at a uniform price, but no system of discrimination would completely overcome the difficulty. Whenever and wherever higher prices are charged in the hope of covering constant costs, the result is bound to be some limitation of demand, and some sacrifice of economically desirable output. The only level of prices which will surely call all available productive powers into use is a bankruptcy level.

Unchecked competition does actually tend in this direction; witness the chronic rate wars among railroad and steamboat lines in the early days. In theory, the same argument which is used to show how competition brings prices down to cost (so far as it does not rest on the intervention of new competitors) can be used to prove conclusively that competition tends to force prices down to the level of differential cost, if existing productive capacity will supply the demand at that price. And as industry is in a chronic state of partly idle capacity, to insist that producers shall compete unchecked appears to amount to inviting competition, and private enterprise with it, to commit suicide.

Since unchecked competition is suicidal and cannot continue, can anything continue which deserves the name of competition, or are we living in a régime of combination and monopoly, and is monopoly essential to the life of private industry? This is a real and serious question. The answer appears to be that business rivalry still exists, subject to checks in the way of understandings and standards of fair tactics, enforced partly by the group ethics of the business community, partly by a lively sense of the need of common self-preservation, which is at the bottom of a deal of the group ethics, and partly by the discipline exercised by the larger and stronger concerns, who can make it decidedly uncomfortable for smaller houses which abuse their privileges and overstep the limits of tolerated trading. Another very effective check, mentioned in an earlier chapter, is cost-accounting. Within what Professor Taussig has called the "penumbra" of supply and demand, cost-accounting can and does frequently govern price policy. A "standard burden rate," including interest on investment, is a very powerful check on price-cutting.

The chief strain, of course, is in times of business depression, and it is a recorded fact, so far as hours of labor performed is a trustworthy index, that the smaller concerns maintain production at such times with far less reduction than the larger ones, which bear the brunt of curtailment. The question at issue really involves a separate analysis of the forces governing prices during booms and during depressions, and the average of the two. We have already given some attention to the means of protecting the overhead costs of business in the downward swing of the business cycle, and the question which remains is equally interesting: namely, whether prosperity makes up for depression, or whether there is an average resultant of net loss.

When demand first begins to revive, the effect is not always an instant increase in prices. As W. C. Mitchell has shown, producers can for a time make increased profits out of increased output, without restoring prices to the level which prevailed before the depression set in. Costs are low, except for the fact that overhead costs are apportioned upon a small volume of output, and this can be cured by selling more goods. Furthermore, the market is likely to be more actively competitive than usual, as the depression has broken down the agreements and understandings by which prices had previously been maintained.[1] But prices do begin to rise before the plants are working at full capacity. At such a time competition takes the form of offering more for the means of production, especially raw materials. Such competition is just as capable of wiping out profit as the competition which lowers prices, and it acts in a more subtle and less obvious way. So long as there is unused capacity, a concern makes a financial gain by buying more materials and working them up, up to the point where the price of materials absorbs all the margin between the selling price of the goods and the differential cost of manufacture. Thus one form of cut-throat competition may still exist on a rising market, so long as productive capacity is not fully utilized.

While prices maintain their upward swing, this form of competition has little chance to act destructively. The rise in prices creates more profits faster than rising costs of materials can wipe them out. And before prices reach their peak, plants are working at full capacity, differential cost is greater than average cost, not less, and the motive to cut-throat competition has disappeared, provided only that the concern knows what is happening to its costs, which is not always the case.[2] The crux of the matter lies in the long-run relation of the supply of productive capacity to the demand.

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[1] Mitchell, *Business Cycles*, pp. 458–59.

[2] Cf. G. E. Putnam, "Unit Costs as a Guiding Factor in Buying Operations," *Journal of Political Economy*, XXIX (October, 1921), 663–75.

2. THE SUPPLY OF PRODUCTIVE CAPACITY

What governs the supply of productive capacity in an industry? The usual answer is that it adjusts itself to the demand by the construction of additional facilities whenever producers see a prospect of marketing their output at a profit. This, it is natural to assume, will not happen until there is demand in sight sufficient to utilize all the existing capacity at a profitable price. But the thing is not quite so simple as this, and will repay a more detailed analysis.

In the first place, owing to the forces already studied in connection with the business cycle, plant capacity is governed far more by the peak demand than by the minimum or the average. If this were not true, and if business did not build for the peak at the time of the up-swing, one of the chief causes of business cycles would disappear. This very building for the peak, timed as it is, tends powerfully to increase the height of the peak itself. True, construction does not catch up with the peak, and there are periods when plants cannot fill all their orders, but these shortages of equipment are not so large nor so prolonged as the surpluses. The most available figures on this point are those of shortages and surpluses of railroad freight cars, published by the Interstate Commerce Commission, but other industries show the same phenomenon.

In the second place, one of the regular sources of the supply of productive equipment consists of individuals or groups trying to set themselves up in business and going through the continual process of weeding out the less efficient. Their primary motive is not to supply an existing excess of demand, but to find a place for themselves in the world of business: and whether this place is found by supplying an inevitable growth of demand, or by building up a new demand or by merely sharing the existing demand, is a secondary matter. In small-scale retailing there is an endless inflow of such enterprise and capital, most of which is soon lost. As the retailer usually rents his permanent quarters this does not mean an indefinite increase in the volume of fixed capital devoted to retailing. Nevertheless, the demand for store space, and the investment of funds in it, is largely affected by this perpetual constituency of transients.

In less degree the same is true of small-scale manufacturing, including those smaller plants which constitute a considerable part of the total producing capacity, even in businesses where the most efficient plant is a very large one, and where a few such large concerns hold a dominant position. The writer has been told of industries in which strong and canny producers, when they wish to expand, do not build, but prefer to let others do their building for them, and then buy them out after they have experienced sufficient discouragements to be willing to sell at a bargain. Such a policy tends to reduce the excess supply of productive equipment, but at the same time it argues strongly that an excess exists, sufficient to overcome the natural preference of successful producers for working with plants of their own designing.

In the third place, the progress of improvements offers the new concern a prospect of making a place for itself, not by virtue of an excess of demand above the capacity of existing plants, but by virtue of the superior efficiency of a new plant which may be able to produce at a profit when older plants cannot. Where this fails, the new plant will still remain in the business, though perhaps under changed ownership; and where it succeeds, the old plants will usually remain, able to produce at a profit when prices are at their highest if not at any other time, and therefore worth maintaining even though there is no continuous use for them. The bringing into service of these semi-obsolete plants is one of the regularly observed features of the prosperity phase of the business cycle.

In the fourth place, if regularization of industry were to be successfully carried out, by working to stock in dull times and by other measures already discussed, much of the business of the peak would be shifted into the hollow, and a serious question would arise whether the outcome would not be an oversupply at all times. Of course the result would soon be to check the building which is now carried on only for the sake of the peak, with the result that the first source of oversupply of plant capacity would be quickly cured, as the permanent growth of demand caught up with the existing supply of plants. While the process was going on, there would be hard times for the capital-producing industries, but if regularization were brought about speedily and generally, this depression would not last long and would merely put an extra strain, for the time being, on the machinery of regularization. And if, as is more likely, regularization were accomplished slowly, the effect would be so spread out as not to make serious inroads on the [illegible] growth [illegible] causes of excess capacity, but it would tend very strongly to diminish one disturbing feature resulting from them: namely, the existence of inefficient plants which are closed a large part of the time and operate only at the height of prosperity. Plants would tend either to be operated or abandoned, and this type of hangers-on would tend to drop out of the business entirely.

To sum up, it appears that there are strong forces at work which tend naturally to produce an oversupply of permanent capital, and there are decided indications that such an oversupply exists.

3. THE MEANING OF "SPOILING THE MARKET"

Granted a surplus of productive capacity, if a producer can cut prices and thereby secure a part of all his competitors' business or the lion's share of the increased business which his reduction of prices brings forth, he can make an immediate gain by cutting, regardless of whether prices cover total expenses or not, provided only they yield something above differential cost. One of the commonest ways of expressing the forces which restrain competitors from carrying price-cutting to the limit is to say that they are held back by a sentiment against "spoiling the market." This phrase suggests so much that it will be well worth while to analyze it and see what definite things it covers.

The first is the obvious fact that such prices will not repay the total sacrifices of production, even for efficient concerns, so that the entire trade will go bankrupt if some limit is not set. This has two aspects: it may be looked at from the standpoint of the trade as a whole or from that of the competitor who initiates a cut in prices. From the standpoint of the trade as a whole there is a vast difference between reducing net earnings from 12 per cent to 8 per cent, and reducing them from 6 per cent to 2 per cent. The total amount lost is the same, but the latter cut is destructive, and is resisted with far more energy and with a real sense of moral reprobation.

This moral condemnation is likely to have a great deal of weight with the competitor who is thinking of initiating a cut in prices, but it may not be decisive so long as it does not prevent him from making a gain for himself by spreading his overhead costs upon a larger total output and so making his reduction of prices more than self-sustaining. In a typical case, trade ethics would deter a competitor from cutting prices if he were already making both ends meet, but a falling off of demand itself reduces his earnings, and if he is in urgent need of funds he may resort to measures he would ordinarily avoid. A stronger deterrent lies in the fact that, if his rivals are forced or provoked into following his lead, he will not hold his increased output, or only a small part of it, and thus his last state will be worse than his first. Except momentarily, the chances are all against his bettering his condition by cutting prices below the level which experience shows to be necessary to cover the overhead costs of the typical producer.

Especially is this true if he is relatively weak and if his rivals are stronger, and are likely, if aroused, not to stop with merely meeting his move, but to set out to punish him by a war of retaliation. Under the present trust laws in the United States, it is natural for large-scale businesses to permit a fringe of competition to survive, some of which they have the economic power to extinguish. They may use this power if provoked, and the weaker producers know it. If the cut in prices did not carry them below what we may call, for lack of a better term, the long-run normal level, the risks would not be so great and many producers might be willing to take them, but beyond a certain point serious danger would begin, and there is no knowing where a price war will stop, once it definitely abandons the attempt to maintain normal prices. During the past year two rival chain-store systems exercised their competitive prerogatives for a short time by giving bread away for nothing.

In the second place, where the producer is a large one and his own output constitutes a substantial portion of the entire market, he cannot increase his business by as large a percentage, with as small a reduction of prices, as is tacitly presupposed in the theoretical economic discussions of competition. Much the same thing is true if he sells a differentiated product, so that in a limited degree the market he sells in is his own, and not a part ~~of a general market shared by all~~ his competitors. Theoretical competition virtually assumes that a very small cut in prices will secure a very large increase in business for the concern which makes it, so that profits are increased, so long as there are any profits at all. Theoretical monopoly assumes that if the concern cuts prices its business can increase only in the ratio of the increase in total demand created by the reduction of prices. In a typical case, a 5 per cent cut in prices might cut the "value added by manufacture" 10 per cent, and might increase demand from 2½ to 7½ per cent, according to its degree of elasticity. The result would be a reduction of net income, such as a monopoly would not willingly incur.

The type of industry we are considering is intermediate between these two limiting cases, and the level to which it pays to cut prices is accordingly lower than if there were a complete monopoly, but higher than the level set by theoretical competition. This does not necessarily mean that the concern makes a profit at all times, or even on the average, since the theoretical competitive price may go down until it fails to cover all the operating expenses; but it means that price tends to stay well above the cut-throat limit represented by differential cost.

A third way of "spoiling the market" is to increase the immediate sale of goods without increasing actual consumption, with the result that when the demand revives the goods already sold at low prices are there on the shelves of dealers, or stored up by the consumer himself, and have to be pushed out of the way, or used up, before new goods can get the full benefit of the revival. Thus it means selling goods when they are cheap instead of waiting and selling the same goods when they are dearer. In other words, regularization spoils the peak of the demand. This argument has its principal force in the case of a large company selling in a market which is partly private. Otherwise the company cutting prices would get a major share of the total gain in the off-peak demand and lose only on its quota of the demand when prosperity should revive. The unabsorbed goods they had sold during the dull period would stand in their competitor's way as much as in their own.

To call this "spoiling the market" seems to imply that unless regularization increases the total demand, taking the cycle as a whole, it is of no benefit to industry. To this there are two answers: regularization cannot fail to involve a material net increase in demand, as well as a transfer from busy to dull seasons, and even if it involved only a transfer it would be a benefit to industry in the same sense in which any improved process benefits it, though, like any labor-saving or capital-saving device, it may cause a surplus of productive power for a time, and bring about some financial hardships.

A fourth form of "spoiling the market" consists in shaking the purchaser's faith in the fairness or economic necessity of the previous level of prices. He comes to think of the lower prices as fair, and judges that they are made voluntarily; and therefore he may be resentful when they rise, and may even be provoked into a "buyers' strike." Mr. C. B. Williams cites a case in which the price was cut to 58 cents in order to enlarge sales in a dull period, though this would not cover overhead costs. When demand revived and the company wished to put the price up to 65 cents, which would be a living rate, the customers objected, arguing that they had a right to assume that the low price would stand unless there were a change in the cost of manufacture, and that they had made their own price quotations on this assumption,[1] and cost of manufacture had not changed.

This case is interesting as showing how moral considerations enter the market and ideas of fairness modify the more impersonal workings of supply and demand. The trade needs to know what to expect and precedents have force. However, the precedent of selling below total cost to stimulate a failing demand,

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[1] See *Year-book, National Association of Cost Accountants* (1921), pp. 199–200.

and restoring a fair price when demand revives, is one to which the trade could become accustomed, especially if the producers who followed this policy took some pains to make clear what they were doing and why: in short, laid their cards on the table. Unwillingness to be frank in such matters, and convincingly frank, is undoubtedly one reason why price policies fail to have their intended effect. The market does not know just what to expect or how to interpret a given move, and therefore holds off when prices fall, or comes on in an uncertain and spasmodic way.

Fifthly and lastly, "spoiling the market" may simply refer to this very habit the market has of responding to a drop in prices by waiting for a possible further drop and so decreasing the demand instead of increasing it.[1] As Taussig points out in referring to this fact, there are limits beyond which this topsy-turvy operation of supply and demand cannot go. Ultimately, a reduction of prices will increase demand and vice versa. But he also remarks that this "ultimately" frequently does nor enter the considerations of business men, who are always immediately confronted by a short-run situation.

This form of spoiling the market is a serious imperfection in the functioning of our chief tool of economic guidance and regulation, and needs, if possible, to be brought under control. A moderate reduction of prices which occurs promptly and having once been made is not likely to be unsettled by further reductions, is the best instrument for reviving demand. It needs to be supplemented by general measures for stabilizing industry, and accompanied by publicity which does not stop short of making known the essential facts as to cost in general, overhead costs in particular and the reasons for the policy followed. If the dominant concerns lent all their force to such a policy they could largely control this variety of "spoiling the market," and as a result, would be able to stimulate demand with a smaller reduction of prices than is now required, and with less uncertainty and general demoralization. Under such conditions it should be possible to reduce prices sufficiently for all necessary purposes, without spoiling the market at all in any real sense, and such a situation would be infinitely healthier for business than a morbid fear of uncontrollable consequences which results in being unwilling to lower prices at all, when a reduction is the only effective remedy the situation permits.

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[1] This meaning is employed by Taussig, "Is Market Price Determinate?" *Quarterly Journal of Economics*, XXXV, 394-411, esp. p. 410, May, 1921.

4. POTENTIAL COMPETITION AS A LIMIT ON PRICES

Where producers have power enough to prevent cut-throat competition, they probably have power enough to set prices above a fair return on the investment, unless some force intervenes which is more subtle and harder to bridle than the direct and obvious competition which they hold in check. Such forces exist, and may be grouped under the general term: "potential competition," though this term, like "spoiling the market" covers a number of different potentialities which are worth distinguishing.[1]

Potential competition refers to the restraint exercised by the knowledge that an attempt to be too grasping will precipitate competition which is not at present active. This may mean the building of new plans, which sprang up in embarrassing numbers to plague the earlier "trusts," before they learned the virtue of moderation. This is a slow and wasteful check, especially where the new plant has to be a large and expensive one in order to have a fair chance of success, but it is effective in keeping extortion within endurable limits. As we have seen, there is a certain supply of new plants to be expected in any case, but a grasping policy on the part of those already in the business may invite more of them to enter and attract men of larger caliber and greater resources, whose rivalry is likely to be a more serious matter.

Another form of potential competition comes from plants of the semi-obsolete type, which will be put into operation if prices rise high enough to make it profitable to do so. Still another type comes from producers already in the field, but who are not at present in this particular market. They may have their markets elsewhere, but stand ready to enter this one if the opportunity seems favorable—perhaps they already have an "outpost of competition" there, which does not do a material amount of business, but keeps in touch with conditions, and stands ready at any time to serve as the nucleus of a campaign. Or potential competition may mean the competition of the mail-order house, the co-operative system, or the cash-and-carry store, which local retailers have to ward off and prevent it from becoming a serious actuality. Where there is a strong co-operative organization having its own wholesale department and to some extent its own factories, it exercises potential competition throughout the market, since it stands ready to establish branches wherever an opening appears promising.

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[1] For an early discussion of the force of potential competition, see J. B. Clark, *The Control of Trusts*.

And lastly, there is the potential competition of producers actually in the field, which has to be reckoned with when their active competition is settled by agreements, understandings, or more informal truces. The more ambitious and grasping such arrangements become, the more likely some member is to break away from them and become an active competitor. It has already been suggested that this kind of potential competition may be a weapon for keeping prices up as well as down: that is, that when the sustaining of prices by large concerns gives small ones a chance to make easy profits by "shading" the established price, they may be kept from abusing their privileges by the fear of retaliatory warfare.

On the whole, potential competition is a mild and tolerant governor of prices. It allows some profits beyond the absolute minimum necessary to sustain private enterprise, but as compared to public regulation of prices it probably makes up for its laxness by the fact that it leaves industry freer from the cramping effect of the system of checks and balances involved in public control. One characteristic feature is that it tends to lose its force unless it now and then emerges from the background and takes the form of actual competition. Thus it is inherently impossible to have industry effectively governed by potential competition alone.

Another unfortunate feature of this natural check on exploitation is that the consumer does not always get the benefit of the reduction of profits. When there is a definite agreement or understanding as to prices and the trade is open to anyone who chooses to come in, the natural result is that the newcomers should be taken into the understanding and maintain the same prices, unless they are so very extortionate that it seems more profitable to take the chances of a price-cutting contest. This possibility would tend to keep the price sufficiently moderate so that a war would not promise large profits, and the trade would not be disrupted on every new arrival. Then the natural tendency would be for new competitors to come in, maintain prices, and share the existing business until ultimately profits came down, and prices and costs of production were brought together, not by bringing prices down to costs, but by bringing costs up to prices, by dividing the existing business up among so many competitors that they all had unused capacity and correspondingly high costs. Fortunately this process could not go on absolutely indefinitely, for if it resulted in very serious inefficiency, a new concern could cut prices, work to capacity, and operate at so much less expense per unit that it could make a profit.

Potential competition operates under one serious disadvantage whenever it depends on the entry into the field of a large new enterprise, with heavy permanent investment. Such an enterprise will have a very appreciable effect on the total producing capacity in the industry, and it may require a considerable reduction of prices to enable all the capacity to find a market. Even aside from this, the entry of a large new competitor will be something the producers in the field cannot let pass unnoticed. They will do something about it. Whatever the conditions are when the promoters of the new enterprise are making their survey of the market, one thing they can be sure of is that conditions will be quite different after they have started business. They will not be let alone: going will not be so easy as the preliminary survey would indicate. Thus there must be a substantial margin of profit to cover these contingencies before a large amount of capital will be tied up in an investment from which there is no easy retreat. Hence the effect of potential competition is quite as satisfactory where it depends on the relatively unobtrusive entrance of small and medium-sized producers, no one of whom is of sufficient importance to provoke a price war.

5. IS COMPETITION RUINOUS?

Does the competition of large business aggregates, with large fixed capitals, tend to force prices below a fair return on capital? The test of detailed study of cases, applied to this question by Professor Eliot Jones, leads to the conclusion that such businesses do not show the effects of ruinous competition.[1] Whatever might be the natural effects of unchecked competition, business has evidently developed checks sufficient to protect its necessary earnings, taking good and bad years together. The disease of chronic financial starvation is far more likely to be found in small-scale industries where many inexperienced managers are trying their hands as independent business men, commonly with inadequate working capital and little knowledge of costs.

Small-scale retailing and farming are probably the businesses in which investigation would reveal the nearest approach to cut-throat competition. The figures of farm incomes, as published by various agricultural surveys, indicate a severely pinched income, though there are disputed questions as to the method of figuring return to land, and other matters which need to be disposed of before these figures can be accepted as fully comparable with similar figures for other industries. Also the farmer suffers little from unemployment or from the business cycle, and he can always eat. Despite these qualifications, however, large groups of farmers show convincing evidences of chronic failure of income to cover fair wages and fair return on investment.[2] The industries which suffer most in times of severe depression appear to be those with a large investment in materials, on which they are forced to take a speculative loss.[1] Apart from these matters, the danger of serious financial trouble appears to be largely a matter of the volume of bonded indebtedness.

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[1] "Is Competition in Industry Ruinous?" *Quarterly Journal of Economics*, XXXIV (May, 1920), 473-519.

[2] See E. G. Nourse, *Agricultural Economics*, chap. xvii, C. and D. "Labor incomes" from nothing at all up to $400 per year appear to be typical, *after deducting 5 per cent on investment.* But as land values are often bid up until the annual rental is capitalized at only 3 per cent, 5 per cent seems too high. The difference, on a farm where the land was worth $20,000, would amount to $400 per year.

6. THE SOCIAL INTEREST IN PRODUCTION VERSUS THE PRIVATE INTEREST IN PROFITS

The interest of the community at large calls for the production of any goods which are worth more than the differential cost of producing them. The private interest of industry requires prices to be high enough to cover the residual or constant expenses of production. As a result prices are frequently high enough to shut off the production and sale of goods which are economically worth producing, for the community. And yet it is equally true that if the community is to be served by private industry, there is virtually no available way to finance the overhead costs except through the prices charged for goods. The question is, then: Can this be done without cutting off desirable production and bringing about economic waste of really serious magnitude? There is always the possibility of cutting this Gordian knot and establishing production on some other basis than that of private business enterprise: some basis which would permit production for human need rather than for commercial profit. Putting it more concretely, the worst wastes of industry are those of the business cycle, or are derived from it, and there is a very real possibility that unless private business can transcend its purely private character and absorb sufficient social accounting to keep these wastes within bounds, the result will be the discrediting of the system of private enterprise and a transition to some other system.

The only system which would be perfectly free to put prices down to differential costs would be a system of public industry with command of the taxing power and the courage to cover most of the constant costs of production by the use of direct taxes.

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[1] Based on an unpublished manuscript by Professor Alvin H. Hansen of the University of Minnesota, already referred to.

Indirect taxes, falling on output, would merely present the same difficulty in another form, and a far less healthy one for the body politic. And direct taxes, to the enormous amount required for the purpose, would be out of the question. Moreover, our systems of correlating taxes and expenditures do not, as yet, afford any check on extravagance or guaranty of apportioning resources according to economic needs, which is anything like as positive and effective as the system of prices and profits. With all its shortcomings, private business follows a less inadequate system of social accounting than any which our political machinery has available to substitute for it. Thus we come back to the problem of making prices to cover constant costs, while minimizing the wastes of unused capacity.[1]

The chief saving fact which prevents this problem from being utterly hopeless has already been suggested. If everyone stood ready to cut prices as far as might be necessary, the worst of the unused capacity would disappear, and with its disappearance, differential costs would rise until they approximated average costs. Therefore, it is not necessary to cut prices to a suicidal point. As we have seen in connection with business cycles, the cutting of prices is only a part of the mechanism necessary to call into use a major portion of our wasted possibilities of production. Some substantial concessions are necessary, but if they are too great they defeat their own end by reducing the purchasing power of those who make them. Furthermore, when demand is active, it exceeds normal productive capacity, and prices can be put high enough to make up the necessary average return, without shutting off any production which the social interest requires. Thus the dilemma of waste due to overhead costs is not insuperable and cut-throat competition is not one of the necessary requisities of social efficiency.

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[1] This dilemma is one of the central features of the economics of A. C. Pigou, Alfred Marshall's brilliant successor in the Cambridge chair of economics. He speaks of it as the discrepancy between supply price (including overhead cost) and marginal supply price (differential cost), and discusses methods of making private net product a better measure of social net product. See his *Wealth and Welfare* (1911) and *Economics of Welfare* (1922).

7. CONCLUSION

The chief conclusion of this chapter may be briefly stated. A certain amount of informal common action is inevitable and necessary in modern industry, thus producing a condition which is neither old-fashioned competition nor complete monopoly. Even without definite agreements, the moral and prudential restraints on cut-throat competition are varied and fairly effective. They are in turn limited by potential competition, which also takes many forms and is a loose but fairly adequate form of control. The result is sometimes to reduce efficiency by dividing up the existing business among too many producers, but this itself has its limits, and if the protective controls which industry already possesses are intelligently directed, they may accomplish whatever stimulation of demand is desirable in dull times without reducing the average yield, through the whole business cycle, to less than the living rate which private industry requires. Cut-throat competition is an evil, and the adaptive reactions of industry give rise to further evils in the way of extortion and bulwarked inefficiency. But these evils have natural limits which prevent them from growing to intolerable dimensions, and while no panacea can be pointed out which will eliminate them without substituting problems of even greater magnitude, much improvement can be expected from the growing intelligence of management and the progressive moralization of industry.

CHAPTER XXII

COSTS OF GOVERNMENT AS OVERHEAD OUTLAYS

SUMMARY

Introduction, 451—Public services and private overhead, 452—Results of this view of public services, 453—Services rendering special benefits, 456—Caring for industry's uncompensated costs, 457—Drawbacks to partnership of government and industry, 457—Conclusion, 458.

I. INTRODUCTION

Think, for a moment, of the nation as a business house; a vast organization for the creation of goods and utilities. Think first of the goods and services which are clearly economic in character, but think also of all the desires, all the ambitions, and all the ideals which require any economic efforts for their furthering. Forget, for the moment, that hazy dividing line which separates the things we are accustomed to call "economic" from those we are accustomed to think of under some other name, and think only of the needs of the mass of human beings and of the essential character of the functions performed in the satisfaction of these needs. And then think of the various kinds of agencies through which functions of a given kind may be appropriately carried on, and the ways in which the burden may appropriately be divided. Last of all, think of the agencies by which these functions are actually carried on, and the ways in which the burden actually is allocated, but try to think of these arrangements as accidents of historical development and to compare them with other arrangements which might be available for the present or the future. Such an effort of imagination is enormously suggestive of experimental possibilities, even if it leads to no definite conclusion.

For the present, the chief effort will be to take the principles which govern a business house in classifying its functions and expenses into direct or indirect, prime or supplementary, special or general, constant or variable, and apply them to all the essential functions of national life, disregarding the traditional boundaries between the private and public economies.

2. PUBLIC SERVICES AND PRIVATE OVERHEAD

In a business house, certain services are directly traceable to certain particular products which benefit from them, and others are not traceable, but must be allocated on some general principle or other. Applying this same distinction more broadly, certain products go to gratify the particular wants of particular individuals, who benefit from them in direct and traceable fashion, and others result in something of general value, enabling the life people lead, with the help of their concrete economic goods, to be a thing of more value, but not in a definitely traceable way. The national welfare is a great bundle of such general services. More specifically, the general functions in a manufacturing plant enable all the special services to be carried on, though the exact benefit is hard to divide between particular products.

In the same way, the general definition and maintenance of personal and property rights creates a system of order which enables the particular operations of each separate business to be carried on, though the benefit is hard to trace quantitatively. A legal case creates a precedent, under which business in general has to live, just as a decision made by the management of a business creates a precedent under which an indefinite number of subsequent operations are carried on. There must be a general system of order, co-operation and division of labor, within each business and in economic life as a whole, and the creation of this system of order is a general, not a special service. In creating an orderly co-operation, people have to be told both what they shall do and what they shall not do. Under our individualistic system government takes the chief responsibility for telling them what they shall not do, but it is not confined to this, for there are such things as traffic regulations, the compulsory spraying of orchards, and many other positive requirements.

Moreover, in a very large section of this work of telling people what they shall not do, government waits for injured or threatened parties to take the initiative, and to prosecute a case, sue for damages, or pray for an injunction. Part of the overhead costs of every industry consists of watchmen and lawyers, playing their part in this maintenance of order, primarily protecting the interests of their own business, but secondarily contributing to the safeguarding and evolution of the entire system of rules and precedents under which business as a whole operates.

The essential functions of government are those which could not be carried on at all by competing private jurisdictions, much as the essential functions of business management are those matters which could not be left to individual workmen to determine each for himself, without destroying the direction, unity, and co-operation of the whole. But there is a vast array of optional functions, which might be parts of the overhead costs of private business or might be handled publicly. The line is an ever shifting one. Many things are of use to an entire business and to many other businesses besides. Some, like streets and postal service, are of use to all businesses and to all individuals besides. The work of the Bureau of Standards, the consular service and Foreign Trade Bureau, the Bureau of Mines, pure-food investigations, agricultural research, mothers' bureaus, childrens' bureaus, the census and the gathering of labor statistics, inspection and grading of goods, and various other services in the creation of the essential conditions of a free, intelligent, and fluid market in which individual demands and supplies may come together—all these bear a relation to industry as a whole or to the gratification of individuals' needs as a whole, similar to the relation which the management of an industry bears to the direct work of turning out products.

3. RESULTS OF THIS VIEW OF PUBLIC SERVICES

But there is no need of multiplying instances, or of overworking the obvious parallelisms which exist. What is their economic importance? What effect can this view of government have on decisions of practical policy? On what problems can it shed light?

One effect lies in regarding government as a productive economic agency of a vital sort, a partner of industry, provider of some of the most vital factors of production, and not an extraneous burden which industry must pay for as a necessary economic evil but whose activities and services belong in another sphere, wholly separate from the economic: the political sphere, which at best touches the economic only to hamper business by regulation. Such a shift in the standpoint from which government is viewed cannot fail to have important effects. The modern enlarged activities of government need not all be classed as burdens; they all have a chance to show themselves economically worth their cost and many can even be financially self-sustaining in a very literal sense. Under this conception, then, government can broaden its functions without encountering the same sort of resistance on the part of public opinion with which a similar enlargement of "political" functions would be met. This is a very real issue, since we are witnessing a great extension of the work of government in the field of economic assistance, research, and regulation, both of particular industries and of industry in general.

A more concrete issue arises from the fact that all these things cost money, and that the resulting need for revenues greatly overburdens our traditional systems of public finance. Under modern conditions of science and specialization, we are organizing and centralizing the work of guidance which each person or each small business used to perform individually, and are building up a vast intangible capital calling for a greatly increased proportion of our economic effort to be spent in centralized organizations of one sort or another. Thus the problems of allocating financial burdens become increasingly pressing.

The common way of raising public funds is on the principle of "ability to pay." This is essentially the principle of "what the traffic will bear," carried to the point of completely disregarding special benefits received or special services rendered. But revenue divorced from special benefit is hard to raise in such amounts as the enlarged tasks of modern governments require, without creating the sort of dissatisfaction which is fatal to any party at the polls. This is true even of indirect taxation, and still more so of direct. Fees for special services, and taxation on the principle of benefits received are strongly indicated as resources for raising the revenues required by the modern enlargements of the work of government.

So far as concerns the basic services of protecting the underlying rights of person and property, ability to pay is one way of measuring benefits received, and probably the most pertinent way. For the government protects the property rights and enforces the contracts by means of which the rich acquire their riches, and under a different system of rights and enforcements, wealth would be differently distributed. Without any supreme central power to define and enforce these rights, there would be nothing like the accumulation of wealth which now exists, and while there would still be richer and poorer, the richer would not be the same persons who constitute the well-to-do class in America today. They would be more of the type of the late Pancho Villa. Thus the theory of benefits and the theory of ability to pay lead to the same conclusion, so far as the central system of maintaining order is concerned.

But many other services cannot easily secure the funds to which their usefulness entitles them, unless they are recognized as forms of economic production, whose costs are essentially part of the overhead outlay incurred for the special processes which benefit from them. As an outstanding example of this, we have already touched upon the revolutionary increase in the volume of highway traffic and the cost of highway construction and maintenance, for which the automobile is responsible. This has revolutionized the requirements of highway financing, making it necessary to place the allocation of burdens on the same general economic basis as that of industrial overhead, and to treat a large part, at least, of the highway budget as the cost of a definite and self-sustaining department of economic production.

Perhaps a still more important effect of regarding government outlays in the light of overhead costs of industry, is the tendency to make specific measurement of benefits in dollars and cents, and to demand that total benefit shall cover total cost before the work can be regarded as worth doing. Especially is this true of those optional functions of government which are performed chiefly because they are more efficient if centralized, and the results can be made more generally useful. If government does not perform them, private industry will, if they appear worth its while. Hence government should not enter the field without a convincing showing of economic reasons why benefits are worth more than costs, even though they do not appear in that light to private industry. There is room for a very great extension of this sort of service, especially in the realm of industrial and economic knowledge. Much of it is the sort of thing which private industry could and should do for itself but which only a large concern could do effectively, on account of the heavy overhead costs. And the results, even if they benefit the whole output of a large enterprise, are less useful than if benefiting the entire industry, and perhaps other kindred industries as well.

4. SERVICES RENDERING SPECIAL BENEFITS

Thus revenues may be raised and costs paid for out of benefits received, with due recognition of the fact that the greater the benefit the greater the paying power, but also with due recognition of the fact that the cost of the service is, after all, largely an overhead cost, and that a charge varying directly with utilization tends to prevent the community from exploiting the service to the full, and from obtaining some benefits which would be worth their cost. Thus an ideal system for financing such services would be a classified system of assessments or fees, making the user share with government the net profits resulting from use, and shrinking to zero when net profits are zero. Actual systems might in many cases be made to approximate roughly to this ideal. However, a tax on net earnings is not easy to administer, and a specific tax on output, with some classification based on size and character of business, might be consistent with promoting maximum utilization, if there were a regular scheme of exemptions in special cases, including industrial depressions.

One possible contrivance to the same end would be a tax based on previous output, averaged over a short term of years, and not on the output of the current year, so that an increase in business would never increase the tax for the same year, and would only affect it in a retarded and diluted fashion. Thus burdens would be gauged by benefits received but an increase in the benefits would not immediately increase the burdens.

5. CARING FOR INDUSTRY'S UNCOMPENSATED COSTS

The case of unemployment insurance, if that were to be made a public function, would be an example of a class of cases calling for a different sort of allocation. Here the burden should be distributed, not according to benefits but according to responsibility for unemployment. This is a type of the government service whose function is to make good some of the costs of industry which would otherwise go uncompensated. Once responsibility for such costs is recognized, it is obviously appropriate that they should be levied upon industry, and should become a part of its overhead outlays.

6. DRAWBACKS TO PARTNERSHIP OF GOVERNMENT AND INDUSTRY

Where government performs services for the benefit of certain industries, thus financing what would otherwise be a part of industrial overhead, the resulting quasi-partnership may have its unfortunate side. It is not easy for government to assist with one hand and regulate with the other. Those engaged in the arm of the service which does the assisting may get the benefit of the suspicion due to regulation or the weariness bred of much investigation and a multitude of questionnaires. The best method which present experience suggests for mitigating this difficulty is to intrust aid and regulation both to a quasi-co-operative, quasi-public organization, in which government and industrial interests are both represented, after the fashion of the Federal Reserve System. Thus government would act in the guise of a partner, even in its regulative capacity, and should be able to avoid part, at least, of the hostility engendered by the regulation of wholly external, political bodies.

In foreign trade this partnership of government and industry is peculiarly unfortunate, as it turns private economic rivalries into governmental rivalries, and is a substantial item in the long list of economic provocations to war. It is not so much what each government does that makes the trouble (though many indiscreet things may be done) as the vaguely magnified suspicions of what others are doing. Yet foreign trade requires that market information be gathered on a large scale and made available to the trade as a whole, and that fellow-countrymen pull together and fund their separate stocks of knowledge, so as to overcome the disadvantages under which they necessarily labor. It is probably healthier, if it can be brought about, to form a co-operative organization to gather trade information and generally care for the intangible overhead costs which are common to all trading in a foreign country. But since such an organization would necessarily be subject to some governmental supervision, probably the most practicable course is to maintain public services of trade information, and make every attempt to keep them above the suspicion of exceeding their proper functions.

7. CONCLUSION

We have seen that there is a tendency for government to enlarge the scope of its work, rendering special services to industry or to other classes of the community, or caring for the uncompensated costs of industry itself. There is a growing tendency for these services to be looked at as things of an economic, not a purely "political," character: indeed the distinction between the political character of government and the economic character of business is becoming very much blurred. Business is becoming distinctly political, what with employees' representation, labor troubles dependent on the verdict of public opinion, and other similar developments. And government is becoming more and more economic. The political arguments and leverages and the sentimental oratory with which people strive to sway purely economic decisions of government grow more and more anachronistic, even at the same time that business finds more and more use for the arts of propaganda and the spellbinder's gift of arousing emotional fervors. And we have seen that the economic functions of government bid fair to render inadequate the traditional methods of public finance and to force a new emphasis on methods more like those used by large-scale business in allocating its overhead costs and in collecting them from the public.

CHAPTER XXIII

OVERHEAD COSTS AND THE LAWS OF VALUE AND DISTRIBUTION

SUMMARY

General laws already touched upon, 459—The meaning of supply, 464—The equilibrium of supply and demand, 465—The worth to industry of a factor of production, 467—"Marginal products" in a partly idle plant, 469—Long-run marginal product, 470—The sum of the marginal products of the different factors, 471—Rewards and the marginal products of the factors, 474—Fast and slow workers, 478—Conclusion: the economy of a dynamic organism, 478.

I. GENERAL LAWS ALREADY TOUCHED UPON

While this study has not been formulated in the technical language of economic theory, it has been constantly dealing with the subject-matter of economic law, from the standpoint of principle, rather than of bare description of fact. As a result, we have accumulated a considerable body of economic generalization, bearing on the facts of overhead costs and decidedly at variance with the assumptions and conclusions of that type of economics which searches for the conditions of a perfect equilibrium of supply and demand, in a perfect market. Besides the points which have already been brought out and definitely expressed, there are others of a more theoretical character, bearing on the fundamental nature of the thing we call "supply" and of the equilibrium between supply and demand, and also on the much disputed question of the relation between the rewards received by the owners of the productive factors and the contributions which those factors make to the joint process of producing goods. Before proceeding to consider these new points, let us review the ones already dealt with.

1. *The nature of markets.*—A market is a connected system of purchases and sales of goods of identical kind, or so similar that the demand for each one is very closely dependent upon the prices of all the others. This system is so tied together that differentials in prices are limited but not eliminated. Prices

may differ from place to place, subject to the costs of transportation and the trouble and cost of investigating the facts and of making a shipment and sale. They may vary from dealer to dealer, subject to the customers' inertia and "good-will." They may differ from brand to brand, subject to the buyers' willingness to take other brands as substitutes. All these limitations require time to take effect, and act progressively rather than instantaneously. And these differentials are not imperfections in the competitive market, but are essential to its "normal" operation, affording the producer who cuts prices his opportunity to profit by his move without having his gains instantly taken away by the action of his competitors. In a sense the typical large-scale manufacturer sells, not in one market but in a connected series of markets, so related that, given the price in one place, the other prices cannot be deduced from the natural laws of competition, though one can set down the limits between which such prices must lie, if competition is actively at work.

2. *The relation of prices to human values.*—As between present and future, high prices may or may not measure high values in terms of human need. Whether they do or not depends entirely upon whether the high price represents general scarcity or general prosperity. In the case of the business cycle—the most typical cause of large swings of prices—high prices measure prosperity and therefore do not measure high values in terms of human need. Therefore the regulating effect of prices, in putting goods where they will do the most good, is to that extent reversed.

3. *The variable supply of productive effort.*—It is customary to assume that a community possesses a given supply of labor and capital, and that under any conditions this supply will be so utilized that more production of one thing means less production of something else. This conception has done duty as an argument against various social get-rich-quick nostrums, and especially against the protectionist fallacy which assumes that if protection results in building up an industry it has created all the wealth the industry produces. The opposite view, that

it has merely directed the country's resources and energies into one channel rather than another, rests on the assumption that the sum of resources and energies is constant. For the purpose in hand, this is nearer the truth than the protectionist position, though it needs some qualification. But when we come to the characteristic problems of overhead costs, we find that they center in the fact that the community is not able to make available the utmost powers it possesses, and that the amount which it does manage to call forth and utilize is continually fluctuating, so that if by any device more of our existing energy can be called forth, there is a clear increase in wealth, which may take the form of capital or consumers' goods, or both. Making more of one thing without, therefore, making less of anything else is a typical occurrence where overhead costs are concerned. Though it always takes place between limits, the limits are sometimes quite wide.

4. *The nature of competition.*—Competition is necessarily a thing of self-imposed restraints, governed by the folkways of the business community even more actively and consciously than by the underlying restraints imposed by government. These latter consist, primarily, of the protection of personal and property rights, most of which are taken for granted and do not require much expenditure of thought except on the doubtful fringes of legality. Agreements, understandings, and the sentiment against "spoiling the market" all play a part in restraining competition, and are limited in their turn by some of the various forms of potential competition. Some of the forces of potential competition do not begin to act until the earnings of the capital engaged in the business are materially above the minimum rate necessary to attract free capital; while some of the forces of active competition continue to act even after prices are below the level necessary to cover operating expenses. Thus competition is a varied and elastic thing.

5. *Competition acts either to lower prices or to raise the amounts offered for the factors of production, or both.*—When demand is strong, competition may actually force producers to raise the price of finished products, when otherwise they would refrain.

For it urges them to bid up the prices of materials and so increase the costs of production. This bidding up of the prices of materials may go to the length of cut-throat competition, but is not likely to do so, since the expansion of demand keeps ahead of it up to the point where there is no more idle capacity.

6. *The market regularly transforms constant costs into variable.*—The passing on of products and services to serve as means of further production results in converting the overhead costs of making these intermediate goods into direct or variable expenses to the industry which uses them, thus falsifying the picture the cost accounts give of the relative amounts of constant and variable costs. Hence financial accounting and cost-accounting on business principles do not fairly represent the actual behavior of the ultimate costs of industry, most of which are constant with reference to the ups and downs of the business cycle, and variable only where the alternative to production is not idleness, but some other productive activity. The two may, nevertheless, be brought a great deal closer together. This can be done in part by developing new forms of contracts, for the proportion of constant to variable costs in a given industry depends upon the forms of contracts under which they secure the use of labor and capital. In part, also, the change may be made simply by a broadened recognition on the part of industrial managers of the true social accounting in the case. The scope of the business man's notion of costs is being much enlarged, and is capable of being well-nigh revolutionized.

7. *The human costs of labor have a two-sided aspect.*—One phase depends upon the fact that the laborer is a conscious being, and from this angle the measure of cost consists of the incentives necessary to overcome his reluctance to work. This is based partly on fatigue as the worker feels it: namely, in its aspect as an unpleasant physical sensation, partly on a number of other qualitative features of the work and working conditions and partly on the enticements of leisure. The second phase of the cost of labor views man as a physiological mechanism, taking for granted that maintaining the mechanism in good condition is of paramount value to its human tenant, whether

he thinks so or not, and whether he knows enough to care for his maintenance intelligently or not.

In general, it appears that the differential sacrifice of additional labor, within the limits of a physiologically normal working-day, is negligible from the physiological point of view, and even from the point of view of the worker's reluctance to work, its money equivalent is far less than its pro rata share of the necessary cost of maintaining the laborer. A large part of this cost, then, becomes a "constant cost" when labor is working at less than desirable capacity, whether from the point of view of physiological upkeep or from the point of view of reluctance to work and the need of stimulus. The ultimate cost of labor is not a variable cost in the sense commonly assumed, but is predominantly a cost which does not vary with output, within the limits set by some of the more pressing and practical problems of increasing utilization.

8. *Social overhead costs.*—Finally, we have seen that government bears expenses which are essentially parts of the overhead costs of industry. It may render services, chiefly by way of research and information (which are overhead costs when the industry takes care of them itself), or it may simply regulate (as the management of a business regulates the doings of the individual workers), or it may care for damages and costs which the industry in question has, for some reason, not compensated. All these are forms of social overhead, and it is in the nature of things that they should be so treated. Government furnishes some vital, if intangible, factors of production; and produces far more than it costs. In one sense its claims are deductions from the general product of industry, but in another sense they are only a part of what government itself produces. We shall return to this question shortly.

These are not all of the general laws and assumptions touched upon in the preceding pages, but they are enough to indicate a very significant revision of the simpler laws of the equilibrium of supply and demand, as well as of the conception of economic efficiency in the large under which the "law of supply and demand" seems to stand for some valid economic good, fit to command the allegiance of men, or at least their satisfied acquiescence. It remains to look more particularly at some matters which are implied in the foregoing discussion, but which have not been formulated.

2. THE MEANING OF SUPPLY

The "law of supply and demand" implies that there is a force, acting from the side of supply, which exerts some controlling influence on prices, and this is commonly thought of as resting at bottom on the physical stock of goods, when it is a case of a short-run situation, and on the physical rate of output when it is a question of long-run equilibrium. The physical stock of goods, of course, is important chiefly from the standpoint of the rate at which it will have to be assimilated in order to prevent an undue accumulation. Thus the question of the present physical stock merges in an estimate of the future rate of replacements, except where goods are perishable (which includes such things as going out of style, becoming shopworn, or losing the value which comes from being the "latest thing").

In the long run, rate of depletion and rate of replacement must be in equilibrium, and this is the most important sense in which supply and demand tend to be equal. But the rate of replacement is not an independent physical fact; it depends upon the relation between prices and costs of production, including the elastic behavior of costs with more or less complete utilization of productive capacity. Thus the underlying physical fact is not supply of goods but supply of capacity to produce them. It is this which determines, over moderately long periods, how large an output a given price will call forth.

This fact is forcibly exemplified in every case where the thing produced is a service, especially such things as railroad haulage and electrical current, and in every case where goods are made to order. For here there is no supply apart from demand; current is not supplied except as some customer turns on the switch and lights his light. Supply and demand are not only equal, but identical, unless the power fails or the supply of freight cars runs short. The only supply which has any existence separate from demand is the supply of productive capacity, and the question whether supply and demand are equal, or what is the effect of supply on price, can have no meaning except as "supply" refers to supply of the means of production or "readiness to serve."

3. THE EQUILIBRIUM OF SUPPLY AND DEMAND

Viewing supply in this aspect the obvious and outstanding fact is that it does not equal demand, nor tend to equal it exactly, not even on the average of its fluctuations. In a perfect static state where there were no business cycles nor other unpredictable irregularities, supply would come much nearer to equality with demand, but there would still be the daily, weekly, and seasonal irregularities which will last as long as people take vacations at the same time of year, and pay other people to feed, transport, and amuse them. And every irregularity results in a definite tendency for the supply of productive capacity to exceed the average demand, being governed largely by the peak.

Idle labor looking for jobs is an unmistakeable example of supply in excess of demand, and no theory of wages can be realistic which ignores this patent fact and its powerful effect on the entire labor situation. Idle capital is only less obvious because it stays in its usual working-place, supported and cared for by its usual guardians, and does not wander about the streets asking for work. In times of depression, prices of goods and rates of wages do not come down to the point where demand for the ultimate factors of production would be equal to supply. They are pegged at higher levels which hark back to the more active times which trade has enjoyed, and hopes to enjoy again. There is a sag, but it is like the sag of a rope stretched across a chasm, and does not reach bottom. These sustaining forces take varied forms, which have already been discussed, especially in connection with the ultimate costs of labor, and cut-throat competition.

What is the supply of labor? The amount actually employed at any time measures demand rather than supply, and the potential amount which can be employed is an indefinitely elastic thing whose limits we must pray never to know, for such knowledge could only come from some appalling catastrophe. For ordinary purposes the maximum volume of labor power employed during a typical business cycle, plus the minimum amount of involuntary unemployment, is probably the most available index of the normal supply of labor power which the population embodies. And it is always in excess of the effective demand.

Another very noteworthy fact which has confronted us in the study of business cycles is that the reduction of demand, which occasions unemployment of labor and capital, constitutes so serious and definite an injury that there is coming to be a sense of obligation for the maintenance of steady demand and of responsibility for the results of failing to maintain it. Producers come to have almost a rudimentary sort of right in the maintenance of demand for their products. They have responded to previous demands by investing their working lives and their capital to supply them, and have by that very fact made themselves to some extent dependent on the continuance of the demand for that general class of services and facilities. Their claim to continuance of demand may be called a natural right, in the rather elastic sense that too great disregard of it brings a natural punishment in the form of a general convulsion of the whole economic system.

The idea that anyone has an obligation to furnish demand, or rather, having once furnished it, to see that it does not collapse—this is a strange conception to find its way into an economics which is accustomed to taking demand as the ultimate starting-point of economic study, and the seat of economic sovereignty, responsible to no one. Producers, in this scheme of thinking, had the privilege of doing their best to anticipate the whims of demand, but there were no obligations on either side, either of continued service or continued patronage. Such obligations, of course, are bound to be defined in the light of reason and common sense, or they will never be made effective at all. People must be able to buy things without being obliged to keep on buying the same things forever, but they may incur some obligation to arrange their buyings with reasonable care so as not to create wanton irregularities, and to finance the general burden of industrial irregularity, in proportion to their share in causing it, and in profiting by irregular use of industrial facilities.

Another vital fact is that demand and supply are so related that the way to maintain demand is to maintain supply, by keeping industry in motion. It is a commonplace that, no matter how much people may want goods and no matter how vital their need, their wants count for nothing as demands unless they have money to spend, which in most cases means a share in the product of some going industry. This amounts, then, to the financial way of saying that unless people have something to give they can get nothing, and there is no economic gain in satisfying their wants. Idle labor is performing an industrial function of the "readiness-to-serve" variety, but it is not one which commands financial recognition under customary forms of contract. If idle time were paid for at the same rate as busy time, the problem of maintaining demand would settle itself, and this would react in the direction of maintaining production in general, though with no guaranty that every particular gap would be filled. But it would not be practicable, nor necessary, to pay the same wage for idleness as for work. A moderate compensation for idle time, falling upon industry as a cost of idleness, would furnish an incentive capable of working wonders in the way of regularizing employment. The market would gain some support from the spending of the unemployment pay, but more from the greater number of laborers with wages in their pockets for work actually done.

Hitherto only the more abstract and impractical breed of economists have interested themselves in the proposition that demand and supply are not separate things at all, but two sides of the same thing. Today, from the standpoint of curing the business cycle, this is one of the most practical and obstinate of realities: it confronts us as "a condition and not a theory."

4. THE WORTH TO INDUSTRY OF A FACTOR OF PRODUCTION

Industry is accustomed to the general idea that its payments for the factors of production are governed by what those factors are worth to the industry. But if the question were raised how the worth of a barrel of flour is divided up among materials, land, buildings, machinery, direct labor, indirect labor, management, and possible patented processes (not to mention government), the answer of the typical business manager would not be satisfying. When wages rise, people will testify on almost any street corner that the new rate is more than labor is "worth," but this generally means only that labor is now worth more than it used to be. Or it may mean that if the claims of all the other factors remain as they are, the whole product of industry will not suffice to pay the new rate of wages and still support the other factors in the style to which they are accustomed. In either case the meaning harks back to the customary rate, either for labor or for the other factors, and has nothing more absolute to stand on.

One school of economists has attempted to give the notion of the worth of the productive factors greater precision, claiming that their worth consists of their "marginal contribution to the product." This means the difference in the product caused by allowing industry one unit more (or one unit less) of a given factor of production, to work with. About this conception volumes of acute and subtle controversy have been written, and it is no part of the task of this book to review this entire literature or settle all the issues raised. The present undertaking will be limited to indicating what marginal product means, in the simplest possible case, what are the essential conditions of its serving as a guide to the distribution of the whole product of industry, and what effect the facts of overhead costs have upon these conditions. We shall find that the outstanding features of our answer are implied in things which have already been said, and that it only remains to translate them into a new terminology and to show their implications. As we should expect, where overhead costs are a substantial item, the perfect theoretical equilibrium is not found. And as it is easier to see these tangible discrepancies than to visualize the conditions of the ideal equilibrium, we can do better if we look at the exception first and the rule afterward.

5. "MARGINAL PRODUCTS" IN A PARTLY IDLE PLANT

When a plant is partly idle, a 5 per cent increase in the direct labor and perhaps a 2½ per cent increase in indirect labor will increase the output approximately 5 per cent. This 5 per cent increase in output is what economists would call the "marginal product" of this addition to the labor force: it represents their immediate productive worth under the existing conditions. Now if these laborers were paid what their marginal product is worth, and other laborers of the same grade were paid the same rates, the whole value of the product would be absorbed before all the operating expenses were covered, leaving nothing for the owners but a deficit. One thing might prevent, namely, if the last 5 per cent of output sold for a lower price than the rest. Then labor might get its "marginal product" without ruining the concern.

This is merely an unfamiliar way of stating a familiar fact: that with some capacity unused the differential cost of producing more goods is low, and it pays to sell them for anything above differential cost, but if all goods are sold as cheap as this, the concern will not even cover all its operating expenses. Hence it must either discriminate, cutting prices to market additional goods while keeping prices up on its existing output, or it must decline chances to make and sell goods which would more than cover their differential cost (and would employ labor whose differential or marginal product would be more than its wages). This means that when a concern protects its overhead and refuses to engage in "cut-throat competition," it is paying labor less than its immediate marginal product. Fixed capital, being in excess, has for the time being no marginal product worth attempting to figure, and if it receives any earnings, they are a deduction from the marginal product of labor.

In the long run and on the average of ups and downs, fixed capital does have a differential productive worth, and the differential product of labor does not absorb the whole income of the concern, in the long run.[1] We shall look into this long-run equilibrium in a moment. Yet nearly every market situation is a short-run situation. Long-run considerations govern the man who is thinking of erecting a plant, but after he has built it, short-run considerations are very urgent upon him and everyone else. This is another aspect of the fundamental dilemma of overhead costs. It means that industry cannot afford at all times to pay labor its full short-run marginal product, because this would leave nothing to cover the long-run marginal product of capital; the two between them absorbing more than the whole product of industry.

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[1] The terms "differential" and "marginal" are here used interchangeably. "Differential" is a more appropriate term for quantities which are not infinitesimal units of an absolute homogeneous whole, but have some size and some individuality.

This is not a peculiar or exceptional condition, but is a special case of a more general law, which cannot be elaborated here, but which can be briefly indicated. Those factors of production which are responsible for the variable expenses behave in such a way that, in general, the sum of their marginal contributions tends to absorb the whole product of the industry, and other factors can get their rewards only as a deduction from the marginal products of the variable factors.[1] Capital is a variable cost in the long run, as we have seen. That is, output cannot be indefinitely increased without more capital, or some other adjustment which would recognize in another way the fact that output is partly governed by the supply of capital. Therefore, capital has marginal productive importance, because there may be more or less of it, and less capital means less product, while more capital means more product. But if there are any forms of capital of which this is not true, whether privately or publicly owned and administered, then they have no "marginal product" and any income they receive is a deduction from the marginal products of the rest.

6. LONG-RUN MARGINAL PRODUCT

What is this long-run marginal worth of capital? How does it arise, what does it look like, and who measures it? It arises (to take a simple instance) when a plant needs enlargement to save it from the prohibitive costs of pushing the existing equipment beyond its capacity, and working night shifts or employing an undue amount of overtime. It enables, let us say, 50 per cent more labor to be employed by a given enterprise and employed to as good advantage as those already there, rather than being so handicapped that their effectiveness would be seriously reduced. This is what would happen if increased capital did not at least keep pace with increased labor. Since it actually does more than keep pace, the excess has to find some uses less productive than this very obvious and very vital one. As we have seen, the excess may go to build more plant capacity of the old sort, which will be useful only at the peak of prosperity, and of doubtful long-run use even then. Or it may go into improving existing plants in a way which does not call for additional labor but gives existing labor better machinery to work with, and results in a moderate increase in the average product per laborer so long as the plant operates. This moderate increase is the long-run marginal product of capital.

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[1] "Variable expenses" here means expenses which vary in proportion to output. This statement, then, is only true so far as there are expenses which behave at least approximately in this way. It is also true for the "total differential costs" (total costs less residual costs), but to formulate it in these terms would be a clumsy task.

Where does it exist and who measures it? It can only be measured where capital has been put into some new form and it can only exist where capital is free to be put into new forms. The best place to measure it is in the calculations of an engineer, estimating whether it will be cheaper to do a given piece of work by hand or with automatic machinery. It is decisions of this sort which determine the disposal and usefulness of the community's marginal supply of capital. If automatic machinery, with the same amount of labor as before, will turn out more goods, that increase is its marginal product; or if it will turn out the same amount of goods with less labor, then the saving of the labor is its marginal product, and is worth whatever the labor is worth. And this means whatever that much labor can add to the product of industry somewhere else.

7. THE SUM OF THE MARGINAL PRODUCTS OF THE DIFFERENT FACTORS

If all costs were variable, then the propositions laid down in section 5, above, would mean that the sum of the marginal products of the different factors in any enterprise (each multiplied by the amount of the factor) would always equal the whole product. This is also what is required if price is to cover all the economic sacrifices of production and no more. Is this a law, a coincidence, or an impossibility? A little analysis will show that it is a law, not a coincidence, though like most economic laws it does not work with absolute accuracy, and it does not apply at all to any factors representing constant costs of production.

Let us start with an illustration of the simplest kind, and the kind which is customarily made in working out this law. Suppose 100 acres of land, cultivated with 1,000 days' labor per year, and raising 20 bushels of wheat to the acre. Suppose cultivation has reached the normal stage of diminishing return for further application of labor to the land, and that accordingly 1,050 days' labor per year on the same 100 acres would yield 2,060 bushels. This means that the marginal product of labor is 60 bushels for 50 days or 1⅕ bushels per day, for the twenty-first "dose" of fifty days' labor.

But this also means something more. Suppose we have 1,050 days' labor to spend on 100 acres, and are offered 5 extra acres of land. This would restore the original "proportion of factors," and the crop would then be 20 bushels per acre again, or 2,100 bushels in all. This involves no new assumption except that the product per acre is the same whenever the amount of labor per acre is the same—a premise we shall examine in a moment. Granting it for the time being, 5 additional acres of land have added 40 bushels to the product, and the marginal product of land is 8 bushels to the acre, when land and labor are in this proportion. Evidently land also is subject to diminishing return, as it must always be when labor is in that stage and the law of proportion of factors is working undisturbed.

Eight bushels per acre multiplied by 105 acres gives 840 bushels. 1⅕ bushels per day's labor multiplied by 1,050 days gives 1,260 bushels. This added to 840 bushels gives 2,100 bushels, or precisely the total product. That this is a law and not a coincidence the reader may test for himself, using any figures he likes so long as they abide by the crucial assumptions of this problem. The truth is that the marginal products of land and labor are not separate facts, they are merely two sides of the same fact, and they are so related that the sum of the marginal products must equal the whole. This same thing holds true for any number of factors and has been demonstrated algebraically, always granting the fundamental premise that the product per unit of any one factor is always the same when the proportion of factors is the same.[1] This virtually means that all expenses vary exactly in proportion to output. It would be roughly true, in the long run, of concerns which have reached standard size, so that further growth yields neither increasing or decreasing cost but requires a harmonious proportionate expansion of all the factors of production. In other words, it is a case in which there are no constant costs, and all costs vary exactly in proportion to output.[2]

But if there are constant costs? They stand for factors of production which have unused capacity. What is their marginal product? An addition to the supply of such factors, might add nothing at all to the product, while to take away part of an organic, specialized plant might destroy its entire productive power. Thus the marginal product might be everything or nothing. In the long run most of these factors reach the limits of their capacity and have to be enlarged and the economies of enlargement somewhere come to an end. But in the meantime much may happen.

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[1] See Wicksteed's pamphlet: "An Essay on the Coördination of the Laws of Distribution," London, 1894, and review by A. W. Flux, *Economic Journal*, IV, 308-13. Flux reduces the demonstration to a mere showing that this is a case under Euler's theorem of a homogeneous function of any number of variables. The product of industry is a "homogeneous function" of the factors of production if, so long as the proportion of factors remains constant, product varies exactly in proportion to the amount of the productive factors at work. The same demonstration has been independently made by Professor C. W. Cobb, of the department of mathematics at Amherst College. Edgeworth has also commented upon this theorem, considering the assumption of a homogeneous function too unreal. It certainly does not fit the facts of overhead costs, as the accompanying discussion shows.

[2] One further corollary of this proposition is worth noting, though not germane to the question of overhead costs. It is the fact that land has a "marginal product" in exactly the same sense as labor. Economists have commonly said that the reward of land differed from that of the other factors, because labor, for instance, received its marginal product, while land rent was a *surplus above the marginal product* of the labor which worked on it. True, but *this surplus is the marginal product of the land, and the reward of labor could be equally well figured as a surplus.* Both methods of figuring apply to both factors. See Flux' review of Wicksteed, cited above, p. 312.

8. REWARDS AND THE MARGINAL PRODUCTS OF THE FACTORS

If a concern striving to enlarge its output bids for the variable factors of production up to their full immediate marginal worth, it will end by paying them all its gross income, and having nothing left to pay for its constant factors. This is precisely what cut-throat competition means, though it generally takes the form of cutting the price of the product until it will no longer cover the overhead costs.

Under these conditions the actual rewards of the productive factors depend chiefly, not on their marginal worth in time of depression, but on their worth during those "normal" times (considerably better than the average) when the capacities of the fixed equipment are fully utilized, when there are no economies of increased output, and the sum of the marginal products of the factors equals the whole income of the business. Wages and interest are governed by this as a limit, but wages, at least, seldom or never reach it. They remain somewhat below it in busy times, leaving the concern a surplus for profits, and they are still lower in dull times, when the concern pays its bond interest out of the marginal products of its variable factors of production.

This is on the assumption that the marginal product of labor means the worth of the marginal man actually employed in a given industry. Using the term in this sense, wages must nearly always be less than marginal product so long as business is run on old-fashioned business principles. And if the marginal product of labor means what the last man would add if all the unemployed were set to work, then no one knows what it is, partly because no one knows just how full the factories would be if all the unemployed were working, and partly because no one knows what would happen to the values of different commodities and to the scheme of values as a whole.

The natural view is that values would collapse through overproduction, and that, therefore, wages would have to be far lower than they are even at the bottom of a depression, in order to make it commercially possible to hire all the unemployed. According to this view, if the marginal product of labor meant the worth of the last employed laborer, it might be next to nothing.

There is reason to doubt this view, and one can only hope with the utmost earnestness that measures for reducing unemployment may go far enough to furnish some approximation to a test, because the test would be virtually certain to disprove the theory. It would require nothing short of a miracle to eliminate all unemployment, as we have already seen in an introductory discussion (chap. ii, sec. 11). Everyone concerned would have to stand ready to cut his demands without regard to his long-run necessities, including capital, dealers who have bought a stock of goods at former higher prices, and laborers who are least able of all to make the cut. But if this miracle were to happen, another miracle would follow, for each industry would protect the demand for everyone else's product by keeping its own employees working and buying goods. Thus no one would have to cut very far; the readiness to do so would be the chief thing needed to save the situation.

To be sure, if we end the waste of unemployment, our national dividend will increase so greatly that we shall have to devise some new forms in which to put our increased consuming power. However, there is little danger of our solving the problem suddenly enough to create real difficulty on that score. A 10 per cent increase in effective use of labor, distributed over twenty years, will hardly be felt, especially as some of the increased earning power may be taken in increased leisure (it is the form and distribution of unemployment, rather than the fact of not working, which makes the real trouble) while some of it will go into public works of various sorts. And if there is still some difficulty remaining, the task of solving it will furnish all the more employment to the country's brain-workers.

In view of all these compensating forces, there can be little doubt that the marginal product of labor, if the vicious circle of unemployment could be broken, would be higher, and not lower, than wage rates are today during a depression, in terms of what money will buy. However, that is not capable of proof.

But we have not done justice to the factors of production, which are "constant" even in the long run and which have no distinguishable marginal product. What are these factors? They include, broadly, all kinds of industrial and commercial knowledge, and all those still more intangible assets which are not so much knowledge as habits of action: valuable lines of least resistance. In short, it includes the entire intellectual and imponderable overhead, whether it is handled by government or traders, whether it is held as public wealth, private property, or "free goods." This includes those services of government without which industry could not go on, and which are in the large sense factors of production of a very vital sort. It also includes, with a qualification, such things as patented processes.

In terms of the productivity theory these factors are in an anomalous position. They make a valuable contribution—often an indispensable one. Yet to exact as their share even a part of what they have contributed, they must take it as a deduction from the marginal products of the variable factors, because there is no other possible source; the products of the variable factors between them absorb the whole dividend. The sum of the assignable parts is unfortunately greater than the whole, on account of the constant elements which cannot be valued marginally.

This proposition takes an interesting form in the case of a patented invention. Royalties, of course, cannot be more than the difference between the product created with the help of the invention and the product which would be secured by the best available unpatented methods. Therefore, they are limited to what may be called in one sense the differential product of the patented process itself. Nevertheless, it remains a deduction from the *present product* of the other factors, and if patents were perpetual, the sum of these deductions would come to constitute an intolerable burden on industry, loading it with taxes corresponding to no present sacrifices of production on anyone's part, and largely crippling the usefulness of the world's stock of industrial knowledge.

It is only by making such things free as fast as possible that industry can be enabled to pay the variable factors of production even approximately the worth of their marginal product, and to bring into existence even approximately all the goods which it is humanly worth while to produce. Industry must stand on the shoulders of previous generations. It cannot get on without the free use of knowledge, and some other things, which have cost their original creators much sacrifice. So far as it is impracticable to turn these things immediately into free goods, they must be paid for, and to pay for them the variable factors must accept some deduction from their marginal products. But every such deduction is to some extent a drag on the full utilization of the world's productive powers, and one requisite of efficient social organization is to keep these deductions down to the lowest amount reasonable and practicable.

It does not require perpetual patents to lay an unduly heavy burden on industry. The mere fact of business secrecy and privacy constitutes an enormous waste, each industry treasuring its own poor secrets in order to be able to take a profit out of the increased effectiveness they give to the factors of production, and lacking the imagination to guess that other producers have secrets quite as valuable and that they would gain vastly more than they would lose by exchange. One great service performed by the report of the "Hoover Committee" on "Waste in Industry" is to lend the weight of engineering authority to the proposition, already a matter of common knowledge, that if each concern would adopt the best methods which are already in use, making them standard practice, the result would be a great increase in efficiency. Even the best plants can learn at some points from their inferiors.

9. FAST AND SLOW WORKERS

One other point must be at least touched upon, before leaving the topic of the relation of overhead costs to the productivity theory of wages. As between individual workers, wages are not gauged exactly according to their productive worth to the industry. A simple piece-wage would satisfy this test, if there were no overhead costs. But as it is, the slower worker keeps the same equipment busy with less output to show for it, and the only wage which would give the faster man his true relative worth would be a progressive price wage. Since industry in general does not follow this system, it does not give the fast worker his full differential worth as compared to the slower worker on the same job. It makes its wage-scales on the basis of giving the worker a stimulus and an incentive, so far as possible, to do his best, but not on the principle of giving him the full commercial value of his excess product. Industry shares it with him, under the usual piece wage, and hence makes a profit on his work, while in the long run it probably loses money on the slowest workers.

10. CONCLUSIONS

One conclusion which cannot be escaped, as one ponders the meaning of these and similar matters, is that our economic society is not put together by simple addition, nor is its income to be allotted by simple division. It is not a mechanical, arithmetical aggregate. The sum of the separate parts may be greater or less than the whole. After all the costs possible are charged against the business operations responsible for them, there remains an undistributed residuum for which someone is responsible. Demand and supply do not tend toward equality, and their discrepancies are themselves costs of industry, of which industry is just now awakening to a partial realization. All in all, the parts of our system are united, not by arithmetical addition nor by the mechanical composition of forces, but in that more thoroughgoing fashion characteristic of the parts of a true organism. Particularly is this true of all the different stages and movements of the business cycle, which is such an ever present fact that hardly any question of overhead costs can be thoroughly discussed without taking it into account. And it is of the very essence of the business cycle that no business works by itself or to itself. Whatever it does starts a series of reactions which ramify over the whole system and return upon their authors in unexpected and unrecognized ways.

And it is obviously a dynamic phenomenon. Most of the special significance of overhead costs is due to dynamic change in industry. But for this, size of plants and output would be so adjusted that constant costs would practically disappear, including even the costs of knowledge, for it is chiefly the knowledge of new things that is costly. Dynamic and organic—such are the dominant qualities of our modern economy of science, machines, and elastic credit systems. Its intricacies are baffling, especially to one whose previous notions of economic law have been largely confined to the static economics of more or less mechanical addition and division which we often imagine ourselves to have received from our ancestors with what injustice to our ancestors we cannot now pause to inquire. A knowledge of the laws of overhead costs is not a master key to all the mysteries of our new dynamic-organic economy; in fact, there is no master key; but it opens many doors, and is one of the indispensable avenues of approach to a better and more systematized understanding of the things which static economics does not explain. In such a study, overhead costs are not exceptions to a general economic law: they are the general law. Dynamic economics must not merely take account of them, it must be built around them, for they are part of its essential framework.

CHAPTER XXIV

CONCLUSION

SUMMARY

The fool-proof machine and the superman economy, 480—Revolution by free contract, 482—Summary and retrospect, 483—Conclusion, 486.

I. THE FOOL-PROOF MACHINE AND THE SUPERMAN ECONOMY

The ideal of the maker of machines is well expressed in the phrase: "fool-proof." This phrase describes a great deal more than a quality of a mechanism: it expresses an attitude toward the average man who uses it. An endless process of learning and growth by the method of trial and error—this is no part of the conception of life which the machine has for its attendants and beneficiaries. "So simple a child can operate it" is a most attractive motto, until one stops to think what it means to a mature mind to spend its working hours doing things a child could do.

But at the same time, this race of machines, with their aspiration toward becoming fool-proof, has built up an economic system which in its larger aspects is the very opposite of fool-proof. In fact, it requires nothing short of superhuman qualities of vision, foresight, correlation and co-operation to make it work without disastrous break-downs. Of course the superhuman governing and correlating might be done by the superior few, leaving the many to lead their fool-proof lives as they will, but for one obstacle. Science and the printing-press have between them made democracy inevitable, economic as well as political, and therefore if social organization requires superhuman vision and powers of correlation, this vision must be grasped by the many and this correlation must be democratically conceived and brought into being.

To be more specific, the problems of overhead costs are, above all things else, not fool-proof. The student cannot be given a formula which will furnish an absolute answer to every question. He must use the highest grade of discriminating judgment if he is to distinguish case from case and to determine which rule applies or which policy is the most promising of results. The parrot which has been trained to repeat: "supply and demand" can no longer qualify as a competent economist nor even a fair caricature.

The remedies for the wastes and misfits of overhead costs are many and difficult, especially as they require businesses to co-operate for certain purposes while competing for other purposes, until it is a wonder the typical business man does not get his economic rôles hopelessly confused. The determining of a wise price policy during depressions, the merging of trade and industrial knowledge into a common fund, the handling of unemployment insurance, the building up of a body of trade ethics which will define harmful types of discrimination and condemn them—all these are co-operative functions.

But always it seems to be organized business which bears the burden, initiative, and responsibility for these co-operative remedies, while the common man goes on his fool-proof way. Not quite, however, for his best faculties of thought and co-operation are needed to work out, discuss, and adopt a scheme of wage payment, soundly based on the facts of overhead costs and tending to give business an incentive to minimize idleness, instead of merely accepting the idleness as a foregone conclusion and attempting to keep wages high enough to pay for it. For a wage policy which involves no increase in output can only raise real wages within very narrow limits, so long as private capital exists in anything like its present form. Increased money wages must inevitably be neutralized by increased prices, so long as the credit system will expand, and probably by lack of full employment after that limit has been reached. And even the taking of all socially unnecessary rewards now going to capital would not give the average laborer a thoroughly satisfactory income on which to raise a family. Individual trades may gain at the general expense, but labor as a whole will be trying to lift itself by its boot-straps. But a wage policy which opens the door to increased output can pay for itself and bring larger real rewards to labor as a whole.

And one of the steps most favorable to the development of such a policy is the establishment of a true relation of partnership between labor and the other parties in industry. Such a relation is well-nigh a necessity in order to make the employer and manager appreciate the true bearings of labor's overhead costs upon industry, and to make labor appreciate more fully the many conditions on which its own continuity of employment depends.

Can the laborer, trained as a cog in a fool-proof mechanism, rise to this demand and meet these requirements? There is nothing for it but to hope most earnestly that he can, for if not, then one might as well admit frankly that the outlook for industrial civilization is dark. The individual must remain responsible for himself as fully as he is now: responsible for mastering his work and doing it well, for finding and keeping a job, and for giving the next generation that training in "gumption" and responsibility for which the best school is but a feeble instrument. But he must also bear responsibility for participating to his utmost, through his union and through other channels, in what is nothing less than the amending of the constitution of industry.

2. REVOLUTION BY FREE CONTRACT

One saving thing about such a rebuilding is that so much of it can be done by the use of the fundamental tool of the present system: free contract. The rights of property in industrial capital can be redivided and altered by this method, until by the time the new system becomes the "custom of the trade," the courts would actually enforce it in the absence of specific stipulations. In this way changes can be voluntarily made which would be unconstitutional if government tried to bring them about by legislative order and compulsion. These contractual experiments might sometimes have to be tried on a large scale to insure success, though many are being tried on a small scale now. One of the most stimulating things in the study of overhead costs—one which most compels the imagination—is the fact that the content and behavior of such costs are governed by the form of industrial contracts. They differ from industry to industry as the result of differences in the forms of contract used and they are capable of being revolutionized by that non-revolutionary method. It is a very long process of education and experiment we have before us, and we cannot begin too soon, making the first of many mistakes and suffering the first of many discouragements.

3. SUMMARY AND RETROSPECT

Looking back for a moment over the course we have traveled, we may be able to gain a more general idea of the character of our journey. We have seen at the start that overhead cost is practically coextensive with unused capacity, and we have studied the various conditions governing the development of the capacities latent in the agents of production. We have seen how the idea of cost originates in certain purposes and depends upon the purposes it is to be made to serve; also that for certain purposes cost is not a mere present fact, but depends on the alternative offered. This is especially true of calculations of efficiency where the object is to minimize waste. We have also seen that the laws of "increasing return" and "decreasing return" need to be reclassified according to the unit in terms of which return is measured, and even more, according to the character of the "independent variable" at work, whether it is the growth of a plant, a change in utilization of an existing plant, or what not. We have seen how some of these independent variables operate, especially the many varieties of business rhythms. We have followed the life-story of an imaginary plant, sampling its problems of cost, and have wrestled with the difficulties of accounting allocation, statistical inference, and expert imputation.

We have studied the special problems of railroads, finding that the traditional estimate of the proportions of constant and variable costs holds true for the seasonal cycle of traffic, but that for other purposes other estimates are needed. We have glanced at a few of the principles governing railroad discriminations, and a few of the many criteria which would have to be taken into account in attempting to base railroad rates on cost in a scientific fashion, so far as may be possible. We have studied the peak-load problem of the public utility industries, seeing how rates are made in systematic recognition of unused capacity; what sorts of classifications are used, the conditions and limitations imposed by public regulation. And we have seen how a definite policy of developing off-peak business may result in a greatly improved load curve and a new peak at a new time of day.

We have very briefly surveyed industries as a whole, finding overhead costs to be universal, and discovering some of the characteristic symptoms in very marked form where we had least been led to expect them. Thus the non-shrinkable character of operating expenses appears very strongly in merchandizing while agriculture is seriously afflicted with the conditions naturally leading to cut-throat competition. There is a rough principle of compensation whereby if an industry does not exhibit one aspect of overhead costs it will emphasize others. If fixed capital constitutes a small portion of its budget, materials may constitute a large one, raising difficulties because they are "sunk costs," irrecoverable in time of depression, and if neither is present and production is on a small scale, this very fact involves a waste of the "intellectual overhead" and a corresponding need for co-operative organization or public aid in order to give the industry the benefit of adequate trade and technical knowledge.

We have seen that overhead costs exist in consumption, and that the ultimate human costs of labor contain a large element of overhead, which the community must bear if the laborer cannot successfully finance it. We have seen how overhead costs act during the business cycle, both as cause and as effect—how the concentrated purchases of capital goods act as a disturbing element, how the accounting that should record the waste of idleness and the need of full production fails to do so, because overhead costs are converted into direct or variable costs by the mechanism of the market in the process of purchase and sale. We have seen how business is awakening to a realization of this fact and even beginning to think and speak of "social cost-keeping"—a form of economic reckoning which cuts through the sophisms of private financial accountancy and calls social waste by its true name.

We have noted the altered principles of responsibility which true social cost-keeping carries with it, as compared to the individualistic canons of responsibility to which business is accustomed. We have seen that to a certain extent opportunity means responsibility; that the person who benefits by a given process, and has power to alleviate evil conditions which result from that process, has a real obligation to do so, regardless whether this is contained in the letter of his contractual stipulations or not. For he is not a member of society by force of contract, older opinions to the contrary notwithstanding, and his social obligations are rooted deeper than any form of mere business agreement. The principle of social responsibility is virtually identical with the principle of incentive, distributing burdens in whatever way may do the most good in stimulating those who can to reduce the wastes of industry. In the light of these principles of rudimentary social accounting we have briefly reviewed the proposed remedies for the business cycle, and have concluded that the cure of this great evil is within the realm of economic possibility.

We have studied the character of markets and of discrimination, with the many forms it takes and the varied purposes which lie behind it, seeing in it an engine of social efficiency, a tool of predatory warfare and oppression, a means alike of personal favoritism or of higher equity, and sometimes the result of sheer ignorance or negligence. We have examined cut-throat competition, the nature and sufficiency of the checks upon its action, and the forms of potential competition which survive when active competition has been largely suppressed. We have found that price is not the result of absolutely uncontrollable forces, but that a considerable measure of discretion exists in the choosing of price policies and enforcing them. This appears to be rather a source of encouragement than otherwise, provided this discretionary power can be guided, harnessed, or otherwise directed toward the type of policy which the principles of overhead costs indicate as most appropriate to the steadying of industry—meaning the steadying of production, not of prices. For, as we have also seen, the absolute steadying of prices is an inappropriate remedy, especially with such an industry as steel, where conspicuous experiments in that direction have been tried.

Finally, we have glanced at the productive services of government and the "factors of production" which it furnishes, viewing them as forms of social overhead, identical in character with some which private industry regularly bears in its own budget. Last of all, we have seen how overhead costs affect the laws by which the produce of industry is apportioned among the contributing factors, making it impossible for each to get its full differential contribution, since the sum of them all would absorb more than the whole product of industry, so that the variable factors must endure a deduction from their "marginal product" if the constant or overhead factors are to get any reward at all. And we have seen that in a study of dynamic economics, overhead cost must be regarded, not as the exceptional circumstance, but as the typical case and one of the central subjects of study.

In covering such a wide range of fact and principle, much has necessarily been left to the reader's own sense and insight, many important subjects have been necessarily dismissed with a brevity which would be regrettable, save that otherwise this range of material could not be placed before the reader at all, in its logical unity and organic coherence, and some things have been reiterated, because they appeared in more than one connection and none of these connections could fairly be ignored. We have to deal with a body of principle, not a series of disconnected problems, and every effort has been made to present it in this light.

4. CONCLUSION

So, at the end, without further apology, we may end our study with a curious wonder at the intricacies of the financial-economic machinery which man has built. Man did not design them; they are rather the unintended by-products of the inventions which he did design to serve his supposed needs. These unintended by-products he does not even understand. They appear with all the force of living things with purposes foreign to those of mankind, because they act in ways which man does not understand and did not plan. No man has yet comprehended them completely. Yet we do know enough to offer some prospect of controlling them, though we must well-nigh remake ourselves and our industrial organization in the process. And so we may look forward, not without hope, to the task of taming the New Leviathan. The stakes are heavy, for if we do not tame him, he may devour us.

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